IMPACT OF FAMILY CAREGIVER TRAINING ON EFFICIENCY AND PATIENT OUTCOMES DURING MEDICARE HOME HEALTH

by
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ABSTRACT

Background: Family and unpaid caregivers are a crucial source of assistance for older adults with disability and/or chronic illness, yet are rarely offered adequate support. Recent revisions to the Medicare Home Health Conditions of Participation require providers to offer family caregiver training; however, little information is now available regarding the scope and consequences of family caregiver training needs in the home health setting.

Objectives: To examine identified need for training among family caregivers providing assistance during Medicare home health, determine how family caregiver need for training varies by caregiving activity, and assess how family caregiver need for training impacts care processes and outcomes during home health.

Methods: This study focuses on community-dwelling Medicare beneficiaries 65 and older who participated in the National Health and Aging Trends Study (NHATS) between 2011-2015 and received home health care within one year of NHATS interview. Multivariable logistic models were used to assess the relationship between older adult characteristics and caregivers' identified need for training, as well as the relationship between family caregivers' unmet need for training and acute care utilization during the episode. Multivariable, propensity score adjusted, logistic and negative binomial models were used to examine the relationship between family caregivers' identified need for training and home health visit type and intensity. All analyses were weighted to account for NHATS complex survey design.

Results: More than 1 in 3 (35.7%) family caregivers assisting during Medicare home health had an identified need for training with at least one caregiving activity. Older adults whose family caregivers had an identified need for training on household chores, self-care tasks, or medication management experienced a greater number of aide, therapy, and nursing visits, respectively. Older adults whose family caregiver had an unmet need for training with any caregiving activity were significantly more likely to incur acute care utilization during home health.

Conclusions: A significant proportion of family caregivers assisting during Medicare home health need training and family caregivers' identified need for training affects care processes and outcomes during home health. Findings reinforce growing awareness that family caregivers require support and training in order to deliver high-quality care.

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CHAPTER ONE: INTRODUCTION

1.1. Background

An estimated 18 million[1] family and unpaid caregivers support and care for older adults through chronic and acute illnesses and transitions of care.[1] These caregivers provide 80% of the total estimated economic value of community-based long-term care for older adults[2] and assist with a range of household chores, self-care tasks, and medically-oriented activities.[1,3,4] A growing body of literature indicates that family caregiver availability, capacity, and characteristics may influence older adults' health care utilization, spending, and outcomes.[5-13] Despite their important contributions, family caregivers are rarely integrated into the care team or offered adequate support.[1,14,15] A majority report feeling unprepared for their caregiving role[1] and fewer than 1 in 10 report receiving any role-related training.[16]

Family caregivers are an especially important resource for older adults with functional impairment and/or chronic illness,[1,3,17,18] such as the 3.4 million Medicare beneficiaries who access home health care each year.[19] The Medicare home health benefit provides eligible beneficiaries with skilled nursing, therapy, and personal care services delivered in the home and is a rapidly growing source of post-acute care for Medicare beneficiaires.[20] Compared to the general Medicare population, a greater percentage of beneficiaries who access home health are 85 years or older (24.5% vs 11.2%), non-white (25.1% vs 11.8%), have three or more chronic conditions (85.9% vs 63.0%), and have two or more functional limitations (32.9% vs 11.7%).[21] Given the social and medical complexity of the Medicare home health patient population and home health

staff's intermittent presence in the home environment, home health providers often rely on family caregivers to help meet patients' care needs.[3,22,23] In 87% of index Medicare home health episodes, clinicians report reliance on family caregiver assistance in addition to care provided by home health staff.[23]

Recent changes to the Centers for Medicare and Medicaid Services (CMS) Conditions of Participation for Home Health acknowledge the importance of family caregivers in this setting by requiring home health providers to offer family caregiver training as needed to implement the plan of care.[24] An emerging body of research demonstrates the potential of family caregiver training interventions to reduce caregiver burden and improve older adult outcomes.[25-31] However, home health providers rarely have formal policies in place regarding assessment and support of family caregivers[22] and little information is now available about the extent and impact of family caregiver training in the home health setting.

There is currently no available evidence regarding which caregivers are most likely to need training during home health, or how caregiver need for training with specific activities impacts care processes and/or outcomes during home health and, therefore, which caregiving activities should be prioritized in training interventions. Studies of family caregiver training have been limited to the ambulatory setting and have largely assessed the effects of training for the caregiver, rather than the older adult.[25-31] The few existing studies of interactions between family caregivers and Medicare home health care providers have failed to consider caregiver training needs or account for

contextual factors prior to the home health episode, such as patient health status and family network composition, and have not distinguished between specific family caregiver activities which may differentially affect care processes and/or outcomes during home health.[32-35]

This study will provide novel information regarding the proportion of family caregivers assisting during Medicare-funded home health care who require training and identify characteristics of older adults and their family and caregiving networks prior to home health that are associated with caregivers' need for training. This study will also determine whether family caregivers' need for training affects care processes (measured by the type and intensity of home health visits) during the home health episode, and whether unmet need for family caregiver training influences outcomes (measured by acute care utilization) during the home health episode. Findings will help guide development and prioritization of training interventions for family caregivers assisting during home health care, thus helping to improve home health care efficiency and quality, will inform policymakers as they pursue additional policies that encourage provider-led support of family caregivers,[36,37] and will guide development of clinician-led training resources for family caregivers.

1.2. Overall Aims and Research Questions

This dissertation aims to examine identified need for training among family caregivers providing assistance during Medicare home health, determine how family caregiver need for training varies by caregiving activity, and assess how family caregiver need for

training impacts care processes and outcomes during home health, among a nationally representative sample of Medicare beneficiaries.

Aim 1. Identify associations between older adult and family and caregiving network factors and family caregiver need for activity-specific training during home health.

1.1 To estimate the proportion of family caregivers assisting during home health who have an identified need for training, across various caregiving activities.

1.2 To identify older adult and family and caregiving network factors that are associated with family caregivers' identified need for training, across various caregiving activities.

Aim 2. Assess whether and how family caregiver need for activity-specific training affects the type and intensity of home health visits.

2.1 To determine whether family caregivers' identified need for activity-specific training affects the likelihood of receiving any nursing, therapy, personal care aide, or training visits during an index home health episode.

2.2 To determine whether family caregivers' identified need for activity-specific training affects the number of total, nursing, therapy, personal care aide, and training visits received during an index home health episode.

Aim 3. Determine whether unmet need for family caregiver activity-specific training affects acute care utilization during home health.

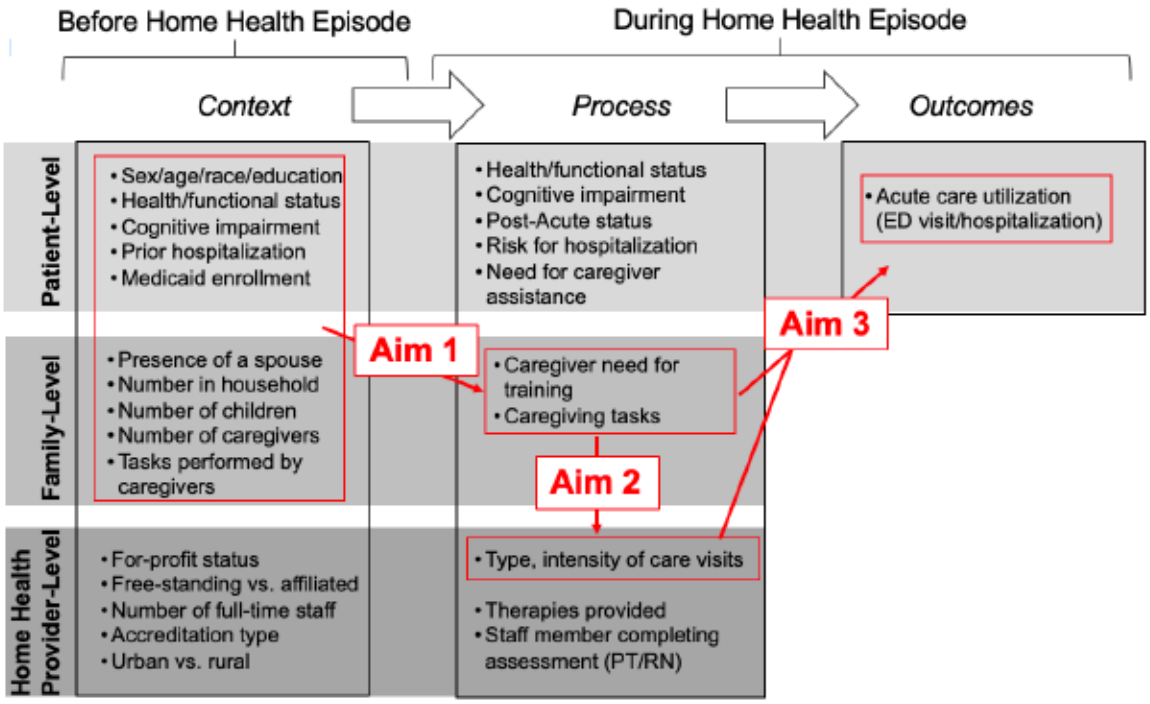
3.1 To estimate the proportion of family caregivers assisting during Medicare home health who have an unmet need for training, across various caregiving activities.

3.2 To determine whether unmet need for family caregiver training, across various caregiving activities, affects the probability of acute care utilization during an index home health episode.

1.3 Conceptual Framework

To guide our study, we developed a framework that recognizes the importance of collaboration between patient, family, and providers, and acknowledges that characteristics present before a home health episode will affect processes and outcomes during the episode (Figure 1.1). Context, process, and outcomes categories from Ryan and Sawin's (2009) model of Individual and Family Self-Management were adapted for this conceptual model,[38] and relevant older adult and caregiver characteristics were drawn in part from Cho (2007)[39] and Chen, et al (2017).[35]

Figure 1.1 Conceptual Framework



1.4 Dissertation Overview

This dissertation is organized into chapters as follows: Chapter 2 presents an overview of data and methods used for this research, including a description of data sources, study cohort, and statistical regressions used in each Aim. Chapter 3 describes the independent research study and findings related to Aim 1, a descriptive analysis of rates of identified need for training among family caregivers, and characteristics associated with identified need for training, during Medicare home health care. Chapter 4 includes analyses and findings related to Aim 2, a propensity score adjusted, cross-sectional study estimating the relationship between family caregivers' identified need for training and the number and type of visits received during Medicare home health care. Chapter 5 presents analyses and findings related to Aim 3, a cross-sectional examination of the associations between family caregivers' unmet need for training and the likelihood of

acute care utilization during Medicare home health care. Finally, Chapter 6 includes a discussion of key findings, study strengths and limitations, and recommendations for future research and policy efforts.

CHAPTER TWO: DATA AND METHODS

2.1 Analytic Dataset

Data Sources

This study relies on four linked data sources: 1) National Health and Aging Trends Study (NHATS), an annual, nationally representative, longitudinal survey of Medicare beneficiaries 65 and older. NHATS includes detailed information on sociodemographic factors, health and functional status, receipt of family caregiving, and family and caregiving network composiiton.[40] 2) Outcome and Assessment Information Set (OASIS), a mandatory, standard patient assessment submitted by home health providers during each Medicare home health episode. OASIS collects a range of data, including patient health and functional status, patient need for family caregiver assistance, family caregivers' need for activity-specific training, and acute care utilization during the episode.[41] 3) Medicare claims data, including information regarding visit type and frequency during a home health episode. 4) Provider of Services file (POS), a listing of Medicare-certified providers, including home health providers, with information on provider characteristics.[42]

We developed a novel dataset linking these data sources for community-dwelling Medicare beneficiaries who participated in the NHATS between 2011-2015 and received Medicare-funded home health within 12 months of survey interview. We linked individual Medicare beneficiaries and their home health providers across the four data sources using existing unique study identifiers and CMS certification numbers, respectively. The availability of these identifiers allowed for exact 1:1 merging of the

data sources. Of the 8,245 NHATS respondents included in the initial 2011 survey wave, 1,758 (weighted n=8,477,990) accessed Medicare home health within 12 months of the initial (2011) or a follow-up (2012-2015) survey. This dataset is used for all Aims.

Study Cohort

To construct this dataset, we pooled NHATS data from 2011-2015 with linked OASIS and Medicare claims data from 2011-2016. For each participant, we matched the OASIS and claims filings for the first (index) home health episode during the study timeframe with the NHATS interview immediately preceding the index home health episode. By pooling responses across years while using appropriate survey weights and design variables, we can maximize sample size, account for complex survey design, adjust for differential nonresponse, and produce nationally representative results.[43,44]

We limit our analytic sample to older adults experiencing an index home health episode, as family caregivers may "learn on the job", becoming more skilled and receiving training as the older adult cycles through multiple home health episodes. Because we focus only on index episodes, each individual is present in the dataset only once. To establish a clear temporal sequence between older adult characteristics measured in the NHATS, including receipt of caregiver assistance, and measures reported in the OASIS, we exclude those whose home health episode occurred in the same month as their NHATS interview date. Given our interest in better understanding interactions between family caregiver need for training and home health care processes and outcomes for older adults, we exclude from our analyses older adults who dwell in

congregate living settings, such as assisted living and skilled nursing facilities, due to the availability of supports in these settings which may substitute for or otherwise affect family caregiving.

Table 2.1 Unweighted Sample Size by Year

	2011	2012	2013	2014	2015*
NHATS respondents	8,245	7,075	5,799	4,737	4,152
OASIS claim within 12 months of survey	769	674	614	565	640
Community-dwelling	661	541	468	384	416
Non-duplicates	n/a	383	237	188	289
Cumulative Total (*without* duplicates)	661	1,044	1,281	1,469	**1,758**

**Continuing sample only (those first sampled in 2011)*

Claims data are only available for Medicare fee-for-service beneficiaries. Therefore, Aims 2 and 3, which rely on claims data to measure the number of visits received during home health and whether any training is received during home health, respectively, are limited to the 1,217 (weighted n=5,870,905) individuals in our study cohort who were enrolled in Medicare fee-for-service at the time of their index home health episode. Additionally, in order to link our dataset to the Medicare Provider of Services (POS) file, which contains information on home health provider characteristics, we used the CMS certification number for each provider. We drew CMS certification numbers from claims data; therefore, information on home health provider characteristics are only available for the subset of individuals enrolled in Medicare fee-for-service.

Complex Survey Weights

The NHATS is a complex, multistage survey which employs stratification and oversampling of specific subgroups of interest.[45] NHATS was initially fielded in 2011 and the sample was replenished in 2015. In each round, weights are calculated which

account for differential probability of sampling (based on demographic characteristics) and nonresponse bias.[43] Using survey design variables and weights available with the NHATS, researchers can account for the complex survey design to produce non-biased standard errors and nationally representative effect estimates.

We note that the NHATS sample was replenished in 2015 and weights for participants entering the sample in 2015 correspond to a different reference population than those for participants who originally entered the sample in 2011;[46] therefore, we limited our dataset to NHATS participants who entered the NHATS sample during the initial round of data collection in 2011. We used analytic weights for the year of observation in our weighted analyses, while limiting the sample to those present in the initial round of data collection. This approach to weighting accounts for complex survey design and weights the sample to all NHATS-eligible Medicare enrollees as of September 30, 2010.

2.2. Measures

Predictor Variables

In Chapter 3, predictor variables include a range of individual and contextual factors measured prior to the home health episode, based on self- or proxy-reported NHATS data. Individual factors include older adult sociodemographic characteristics (age, sex, race, education, Medicaid and Medicare Advantage enrollment, educational attainment) and health status (fallen in past year, hospitalized in past year, number of chronic conditions, probable dementia). Contextual factors include availability of family or unpaid caregivers (whether the older adult lives alone, number of family or unpaid

caregivers, presence of any paid caregiver), and receipt of family caregiver assistance (hours/month of family caregiver assistance received, types of family caregiver assistance received).

In Chapter 4, predictor variables include family caregivers' identified need for training with various caregiving activities: household chores, self-care tasks, medication management, and patient supervision. Home health clinicians document whether an older adult needs family caregiver assistance with specific activities, whether they receive this assistance, and whether the caregiver needs training/supervision in order to provide this assistance using OASIS.[41] For each activity, we constructed a binary indicator of whether the family caregiver had an identified need for training, limiting the sample to cases in which home health clinicians identified the older adult as both requiring and receiving family caregiver assistance with that activity.

In Chapter 5, predictor variables include activity-specific unmet need for family caregiver training, measured using information from both the OASIS and Medicare claims. From the OASIS, we determined whether the family caregiver had an identified need for training with the given activity, based on home health clinician reports as described above. From claims data, we determined whether any training had been provided during the older adult's 60-day index home health episode. Claims include a count of the number of training visits, defined as visits made by a Registered Nurse (RN) or Licensed Practical Nurse (LPN) to offer training/education. As the majority of the sample

(weighted proportion=67.82%) experienced zero training visits, we created a binary variable equal to "1" if any training visits were received and "0" otherwise.

We then created a binary indicator of unmet family caregiver need for training. We considered there to be an unmet need for training if the family caregiver had an identified need for training but did not receive any training visits, and no unmet need for training if 1) the family caregiver had no identified need for training or 2) if the family caregiver had an identified need for training but received training visits. We measured unmet need for training within each of the four caregiving activities (household chores, self-care tasks, medication management, and patient supervision) and created an indicator for unmet need for training with *any* of these four activities.

Outcome Variables

In Chapter 3, outcome variables include family caregivers' identified need for training with various caregiving activities: household chores, self-care tasks, medication management, and patient supervision, as defined above.

Table 2.2 Identified Need for Training among Family Caregivers Assisting during Medicare Home Health, by Caregiving Activity*
(n=1,758 unweighted; n=,477,990 weighted)

Caregiving Activity (n, older adults receiving assistance)	**Identified Need for Training** (Treatment)	**No Identified Need for Training** (Comparison)
Household chores (*n=1,558*)	13.0%	87.0%
Self-care (*n=1,470*)	26.6%	73.4%
Medication management (*n=1,230*)	29.1%	70.9%
Patient supervision (*n=1,077*)	20.4%	79.6%

**(Unweighted n), weighted %*

In Chapter 4, outcome variables include receipt of any nursing, therapy, personal care aide, or training visits during the home health episode, as well as the number of total, nursing, therapy, personal care aide, or training visits received during the episode. Medicare home health is reimbursed and delivered in 60-day episodes of care.[48] (Note: beginning January 1, 2020 reimbursement periods have been shortened to 30 days.[49]) During an episode of care, the patient may receive varying numbers of visits from home health staff and these visits may include a mix of skilled nursing, skilled therapy, personal care aide, and other service types.

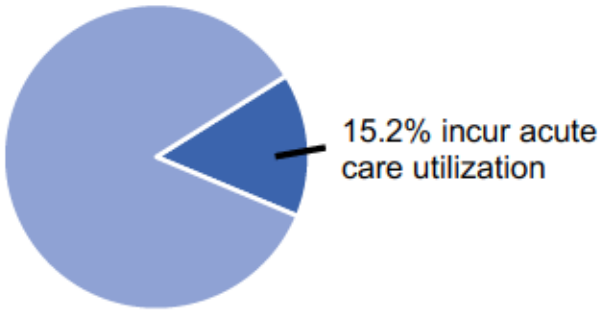
Using Medicare claims, we derived counts of home health visits provided within the 60-day index home health episode. We created count variables for number of nursing, therapy, aide, training, and total visits incurred in this timeframe, identifying the type of visit using Healthcare Common Procedure Coding System (HCPCS) codes.[47,50] Nursing visits include visits from a Registered Nurse (RN) or Licensed Practical Nurse (LPN) to provide direct care, evaluate the plan of care, or observe/assess patient's condition. Therapy visits include visits from a Physical Therapist (PT), Occupational Therapist (OT), Speech Language Therapist, or PT or OT Assistant to provide direct care or develop a program of therapy. Personal care aide visits include visits from a Home Health Aide. Training visits include visits from an RN or LPN to offer training/education to patients or family members. We calculated total visits by summing the number of reported nursing, therapy, aide, and training visits. We also created binary indicators of whether the older adult received any nursing, therapy, personal care aide, or training visits.

Table 2.3 Average Visits Received during Index Home Health Episode, among Community-Dwelling Medicare Beneficiaries Receiving Home Health between 2011-2016 (n=1,217 unweighted, n=5,870,905 weighted)

Number of home health visits, by visit type:	Mean ± *SE*
Total visits	16.9 ± 0.47
Nursing visits	7.2 ± 0.26
Therapy visits	8.1 ± 0.32
Aide visits	1.6 ± 0.17
Training visits	1.4 ± 0.14

In Chapter 5, the outcome variable is acute care utilization during the index home health episode, measured using OASIS filings. We first identified whether each study subject had any OASIS filings indicating Emergency Department (ED) use or an inpatient hospitalization during their index home health episode. These include OASIS filings indicating a resumption of stay following an acute care hospital stay or transfer to an inpatient facility, OASIS filings indicating that the patient is being discharged to an acute care hospital, and any OASIS filings which are not the Start of Care assessment which indicate ED use since the previous OASIS assessment. We then create a binary indicator of acute care utilization for each individual.

Figure 2.1 Rate of Acute Care Utilization among Community-Dwelling Medicare Beneficiaries Receiving Home Health between 2011-2016 (n=1,217 unweighted, n=5,870,905 weighted)



Covariates

We measured a range of covariates which capture older adult characteristics and contextual factors prior to home health (from NHATS), older adult and family caregiver characteristics during home health (from OASIS), care intensity during home health (from claims data), and home health provider characteristics (from POS files).

From NHATS, we drew measures of older adults' sociodemographic characteristics (age, sex, race, Medicaid-enrollment), receipt of family caregiver assistance (number of caregivers, types of caregiving assistance received), living arrangement (whether they live alone), and health status (number of chronic conditions, fallen in past year, hospitalized in past year, self-reported overall health) prior to home health. Types of caregiver assistance received include any assistance with household, mobility, or self-care tasks due to issues with health or function or assistance with medication management.

From OASIS, we drew measures of older adults' living arrangement (whether they live alone), post-acute status (whether they received inpatient care within 14 days of home health care), treatments received (any respiratory or intravenous therapy), clinical severity (overall clinical severity, presence of pressure ulcer, presence of surgical wound), functional impairment, and cognitive impairment during home health. Overall clinical severity and functional impairment during the home health episode were determined from Health Insurance Prospective Payment System (HIPPS) codes.[51] These codes are used for home health payment risk adjustment[51] and identify home

health patients as having little or no, moderate, or significant functional impairment and low, moderate, or significant clinical severity. Cognitive impairment was measured via home health clinician assessment of the older adult.[41] Older adults were considered to have no cognitive impairment if the home health clinician noted that they were "alert and oriented…comprehend and recall task direction independently" and some cognitive impairment otherwise.[41]

From claims data, we measured care intensity by the number of nursing and therapy visits received during the episode. From POS, we measured whether the home health provider is nonprofit, defined as a nongovernmental agency exempt from Federal Income taxation pursuant to section 501 of the Internal Revenue Code of 1954,[52] the number of full-time-equivalent employees at the home health provider, and whether the home health provider is affiliated with an acute care hospital.

Missingness

Less than 5% of observations had missing values for any variable of interest from the NHATS or OASIS data. Given these low levels of missingness, we recoded missing observations to the modal value for each variable among our analytic sample, with the exception of the main predictor and outcome variables for each aim. The following variables had <5% missingness and so missing values were coded to the mode: race, educational attainment, Medicaid enrollment, presence of paid caregiver, living alone, self-reported overall health status, fallen in past year, hospitalization in prior year,

presence of surgical wound during home health, and presence of urinary tract infection during home health.

Observations with missing data for the main predictor or outcome variables were dropped, resulting in 7 observations being excluded from the dataset. All 7 were missing OASIS data on caregivers' identified need for training. No observations in the analytic sample were missing data on acute care utilization during the home health episode (drawn from the OASIS), likely due to the administrative nature of this data source and its link to provider payment. Claims data and POS data were missing for all Medicare Advantage enrollees (n=541); thus, analyses in Aims 2 and 3 were limited to the 1,217 Medicare fee-for-service enrollees in the study cohort.

2.3 Methods

Propensity Score Adjustment

In Chapter 4 we rely on propensity score adjustment to minimize bias stemming from endogeneity. There are a number of underlying patient characteristics that could confound the relationship between caregiver need for training and the number/type of home health visits received by the patient. To address this threat, we use propensity score adjustment to yield treatment and comparison groups that are balanced with regard to observed characteristics, allowing for an unbiased estimation of treatment effect, assuming no unmeasured confounders.[53]

Propensity scores model a subject's probability, based on observed characteristics, of receiving the treatment of interest—in these analyses, the treatment is a family

caregiver's identified need for activity-specific training. Weighting each individual based on their probability of receiving the treatment yields treatment and comparison groups with similar distributions of observed covariates, thus minimizing the threat of endogeneity.[53] For each caregiving activity, we used logistic regression to model the propensity score for each older adult receiving family caregiver assistance with that activity as a function of the following observed potential confounders: older adult sociodemographic characteristics (age, sex, race, level of education attained, Medicaid-enrollment), health status (probable dementia, number of chronic conditions, hospitalization in the past year, fallen in the past year, self-reported overall health status, use of a proxy respondent), caregiver availability (marital status, number of children, living alone or with others, presence of a paid caregiver, number of family caregivers), and types of caregiver assistance received (assistance with household chores, mobility tasks, self-care tasks, medication management, and doctors' visits). We weighted the propensity score estimation models using NHATS survey weights, an approach to accounting for complex survey design in the estimation of propensity scores which has been described and evaluated previously by Ridgeway et al (2015).[54]

We then derived composite weights for each individual that adjusted for both propensity score and the complex survey design. First, to adjust for propensity score, we employed weighting by the odds: treated individuals received a weight of 1 and untreated individuals received a weight of e/(1-e), where e represents the individual's propensity score.[55,56] Then, to account for the complex survey design, we multiplied each individual's propensity score weight by their survey weight to create a composite weight

for use in the final analyses, following an approach suggested by DuGoff et al (2014) and Ridgeway et al (2015).[54,55]

Multiplying across propensity score weights and complex survey weights may produce some extreme weights. To address these outliers, weight trimming is suggested, a process by which the researcher reviews the distribution of weights, identifies outliers, and sets outlying weights equal to either a lower or upper bound weight.[53] We experimented with four possible truncation strategies: 1) no truncation, 2) truncating to the 99th and 1st percentiles, 3) truncating to the 95th and 5th percentiles, and 4) truncating to the 90th and 10th percentiles. After consideration of the distribution of weights between treated and untreated individuals (using box plots and kernel density graphs), we chose to truncate outliers to the 99th and 1st percentiles. This truncation strategy allowed us to minimize the impact of outliers while maintaining important information regarding non-probability sampling included in the survey weights.

A common numerical summary of "balance" between treated and untreated individuals, meaning similar covariate distribution across these groups, is standardized mean difference (SMD). SMD is the difference in means between the two groups for a given covariate, divided by the standard deviation. After weighting, treatment and comparison groups should have a SMD of less than 0.1 on observed covariates to produce sufficient reduction in bias due to those covariates.[56] We used the "pbalchk" command in Stata 14 to calculate SMDs between treated and untreated individuals both before propensity score adjustment (using only complex survey weights) and after application of the final

analytic weights. We include these results for family caregiver training with medication management below in Table 2.4; similar patterns were repeated across all caregiving activities of interest. We found overall good balance prior to propensity score adjustment, but improved balance after the composite weights were used.

Table 2.4 Comparison of Covariate Balance between Treated and Untreated Individuals, Before and After Propensity Score Adjustment[*,†] (n=1,217 unweighted, n=5,870,905 weighted)

Older Adult Characteristics[§] (mean)	Before Propensity Score Adjustment (Weighted using Complex Survey Weights Only)			After Propensity Score Adjustment (Weighted using Final Analytic Weights)		
	Treated	Untreated	SMD[‡]	Treated	Untreated	SMD[‡]
Age	79.6	80.4	0.10	79.6	79.8	0.02
Male sex	0.38	0.43	0.09	0.38	0.38	0.003
Non-white race	0.22	0.20	0.05	0.22	0.20	0.05
High-school graduate	0.38	0.37	<0.01	0.38	0.39	0.04
Medicaid-enrolled	0.18	0.16	0.05	0.18	0.15	0.06
Proxy respondent	0.10	0.15	0.14	0.10	0.12	0.04
Marital status	0.47	0.49	0.04	0.47	0.48	0.02
Number of family caregivers	1.63	1.74	0.07	1.63	1.57	0.04
Number of children	3.17	3.22	0.02	3.17	3.18	0.002
Lives alone	0.34	0.28	0.14	0.34	0.31	0.07
Any paid caregiver	0.17	0.19	0.05	0.17	0.18	0.03
Receipt of family caregiver help with:						
Household chores	0.49	0.60	0.23	0.49	0.47	0.02
Mobility tasks	0.27	0.31	0.08	0.27	0.27	<0.001
Self-care tasks	0.27	0.31	0.09	0.27	0.28	0.02
Medication management	0.16	0.24	0.18	0.16	0.16	0.003
Doctors' visits	0.43	0.52	0.16	0.43	0.45	0.02
Cognitive impairment	0.19	0.25	0.14	0.19	0.20	0.02
Number of chronic conditions	0.58	0.77	0.15	0.58	0.63	0.03
Hospitalized in past year	0.33	0.30	0.06	0.33	0.33	0.001
Fallen in past year	0.43	0.45	0.04	0.43	0.43	0.005
Self-reported health	1.22	1.17	0.06	1.22	1.14	0.09

* Treated individuals are those whose family caregivers have an identified need for training with medication management; untreated individuals are those whose family caregivers do not have an identified need for training with medication management.
† Data are drawn from National Health and Aging Trends Study (NHATS) and linked Outcomes and Assessment Information Set (OASIS) and Medicare claims data for 1,217 Medicare beneficiaries receiving family caregiver assistance during home health, 2011-2016.
§ Categorical and binary characteristics are reported as means of their coded values.
‡ Standardized Mean Difference, presented as an absolute value; SMDs <0.10 are necessary to produce an unbiased regression analysis.

Regression Analyses

In Chapter 3, we describe characteristics of older adults receiving help across four caregiving activities (household chores, self-care tasks, medication management, and patient supervision), stratified by whether their family caregiver did or did not have an identified need for training. To test for differences between groups, we used weighted Satterthwaite Rao-Scott chi-square tests of independence for categorical variables and weighted t-tests for continuous variables. We then sought to understand whether and to what degree these observed associations were attenuated by older adult health and functional status during the home health episode. To do this, we constructed logistic regression models to assess family caregiver need for training as a function of older adult characteristics and caregiving patterns prior to the home health episode. These models tested each characteristic individually while adjusting for relevant health and functional status information gathered during the home health episode (older adult post-acute status, cognitive impairment, functional impairment, and clinical severity). All analyses used survey weights and design variables to account for non-probability sampling and to produce nationally representative estimates. Analyses were conducted using SAS version 9.4 (SAS Institute, Inc., Cary, NC).

In Chapter 4 we used multivariable, weighted logistic regression models to model the odds of receiving any nursing, therapy, aide, or training visits during a Medicare home health episode, as a function of family caregivers' identified need for activity-specific training. Multivariable, weighted negative binomial regressions were used to model the expected number of total, nursing, therapy, aide, or training visits during a Medicare

home health episode, as a function of family caregivers' identified need for activity-specific training.

All models adjusted for older adults' sociodemographic characteristics (age, sex, race, Medicaid enrollment), receipt of family caregiver assistance (number of caregivers, types of caregiving assistance received), living arrangement (whether they live alone), and health status (fallen in past year, self-reported overall health) prior to home health, older adults' living arrangement (whether they live alone), post-acute status (whether they received inpatient care within 14 days of home health care), treatments received (any respiratory or intravenous therapy), clinical severity (overall clinical severity, presence of pressure ulcer, presence of surgical wound), functional impairment, and cognitive impairment during home health, and home health provider nonprofit status. All models were weighted using composite weights to adjust for both propensity score and complex survey design. All analyses were performed using Stata 14 (StataCorp LLC, College Station, TX).

We also employed two sensitivity analyses. First, given that our treated and comparison groups exhibited relatively good balance on observed covariates even prior to propensity score adjustment, we duplicated all regression analyses, as described above, without propensity score adjustment. Second, we examined the sensitivity of propensity score adjusted results to a potential unobserved confounder. Following an approach developed by Greenland (1996)[57] we estimated the relationship of interest (as an odds ratio with 95% confidence interval) between family caregiver need for activity-

specific training and odds of receiving any nursing, therapy, aide, or training visits, while adjusting for a potential unobserved confounder.

In Chapter 5, we used weighted, multivariable logistic regressions to model the odds of acute care utilization among older adults receiving Medicare home health care, as a function of family caregivers' unmet need for training with specific caregiving activities. All models adjusted for older adults' sociodemographic characteristics, health status, and receipt of family caregiver assistance prior to home health, older adults' living arrangement, post-acute status, treatments received, clinical severity, functional impairment, cognitive impairment, and care intensity during home health, and home health provider non-profit status, number of employees, and hospital affiliation. All models were weighted to provide nationally representative estimates and account for complex survey design. All analyses were performed using Stata 14 (StataCorp LLC, College Station, TX).

CHAPTER THREE: IDENTIFIED TRAINING NEEDS AMONG FAMILY CAREGIVERS ASSISTING DURING MEDICARE HOME HEALTH

3.1 Abstract

Background: Family caregivers play an important role during home health care. Medicare-funded home health providers are now required to provide training to family caregivers in an effort to improve care quality, yet little information is available to guide these efforts.

Objectives: Estimate the proportion of family caregivers with an identified need for activity-specific training during Medicare home health and identify characteristics associated with caregiver training needs.

Methods: Nationally representative retrospective cohort study of 1,758 Medicare beneficiaries who participated in the National Health and Aging Trends Study (NHATS) and received Medicare-funded home health care between 2011-2016. From NHATS data we drew measures of older adult and caregiving network characteristics before home health (sociodemographic factors, caregiver assistance, older adult health and function). From home health patient assessments, we drew measures of characteristics during home health (admission source, older adult health and function, family caregiver need for training).

Results: More than 1 in 3 (35.7%) family caregivers assisting during Medicare home health had an identified need for training with at least one caregiving activity. Rates of need for training varied widely from 8.6% among caregivers helping with advocacy to

48.2% among caregivers helping with medical procedures. In weighted analyses that adjusted for older adults' health and function, family caregivers were more likely to have an identified need for training with household chores (aOR: 1.74; p=0.01), self-care tasks (aOR: 1.45; p=0.03), medication management (aOR: 1.60; p=0.01), and patient supervision (aOR: 1.90; p<0.001) if assisting an older adult who had not received caregiver assistance prior to home health.

Conclusion: Findings highlight the pervasiveness of family caregivers' need for training and suggest that transitions of care present providers with critical opportunities to connect family caregivers with training resources.

3.2. Introduction

Family and unpaid caregivers are an important source of care for older adults with disabilities and/or chronic illness[3,10,58] and emerging literature suggests that family caregiver characteristics affect older adults' ability to remain safely in the community, avoiding unplanned healthcare utilization and entry into institutional care.[8,9,59-61] There is mounting evidence that providing training for family caregivers may reduce caregiver burden and improve older adult health outcomes,[10,25-28] yet the majority of family caregivers report feeling unprepared for their caregiving role[10] and fewer than 1 in 10 report receiving role-related training.[16] Despite the potential value of family caregiver training, little is known regarding what proportion of family caregivers need training, how need for training varies by caregiving activity, and what characteristics are associated with need for training.

Family caregiver training is especially important within the context of the Medicare home health benefit, through which eligible beneficiaries receive skilled nursing, rehabilitation therapy, and personal care aide services in their homes. The home health patient population exhibits significant social and medical vulnerability,[21] and home health clinicians and staff are only present in the home environment intermittently. As a result, home health providers commonly rely on family caregivers to help meet patient care needs. In 87% of Medicare home health episodes, home health clinicians report a need for family caregiver assistance.[62] The Centers for Medicare and Medicaid Services (CMS) recently mandated that home health clinicians assess caregivers' ability to provide assistance and offer training as needed.[24] However, there is limited information

available to guide providers' efforts in designing and implementing family caregiver training programs.

This study draws on a unique dataset combining a nationally representative survey of older adults with linked Medicare home health patient assessments. We estimate the proportion of family caregivers identified by home health clinicians as requiring activity-specific training during a Medicare home health episode, and identify characteristics associated with caregivers' need for training. Findings are relevant to home health providers' efforts to comply with new CMS requirements and to ongoing efforts to better support family caregivers of older adults within care delivery settings.[10,14,25,63,64]

3.3 Methods

Data Sources

Data for this study were drawn from the National Health and Aging Trends Study (NHATS) and the Outcomes and Assessment Information Set (OASIS). NHATS is an annual, nationally representative survey of Medicare beneficiaries ages 65 and older that collects comprehensive information on participants' sociodemographic characteristics, health and functional status, and support from family and unpaid caregivers during in-person interviews.[65] OASIS is a standardized patient assessment completed by home health clinicians and submitted to CMS at regular intervals during a Medicare-funded home health episode. OASIS includes information regarding the home health patient's clinical and functional status, plan of care, and receipt of family caregiver assistance.

Study Cohort

The study included 1,758 community-dwelling older adults who participated in the 2011 NHATS and received home health care within one year of the baseline (2011) or a subsequent follow-up interview (2012-2015). To construct this dataset, we pooled NHATS data from 2011-2015 with linked OASIS data from 2011-2016 and matched each participant's OASIS Start of Care filing for their index home health episode with the immediately preceding NHATS interview. We exclusively examined the index home health episode; therefore, each participant appears in the dataset only once. We excluded NHATS participants who did not receive home health care during the observation period, as well as those living in congregate settings (i.e. assisted living facilities), due to the availability of supports that may substitute for or otherwise affect family caregiving. This study was deemed exempt from human subjects review by the Johns Hopkins School of Public Health Institutional Review Board.

Measures

Older Adult Characteristics

From NHATS, we identified older adults' sociodemographic characteristics (age, sex, race, educational attainment, Medicaid-enrollment), living arrangement (living alone), caregiving patterns (presence of a paid caregiver, number of caregivers, hours of care/month, types of assistance received), dementia status, and health status (number of chronic conditions, fall or hospitalization in prior year). Types of caregiver assistance received include assistance with household, mobility, or self-care tasks due to health or

functional issues and assistance with medication management. Dementia status was determined from self-reported physician diagnosis of Alzheimer's or dementia, proxy respondent responses to a dementia screening tool, and older adult performance on cognitive tests in the NHATS, as described previously by Kasper et al (2013).[66]

From the OASIS, we identified measures of older adults' health (cognitive impairment, functional impairment, clinical severity) and post-acute status during the home health episode. Cognitive impairment was measured via home health clinician assessment of the older adult: we considered older adults to have no cognitive impairment if the home health clinician noted that they were "alert and oriented…comprehend and recall task direction independently" and some cognitive impairment otherwise.[41] We drew measures of functional impairment and clinical severity from Health Insurance Prospective Payment System (HIPPS) codes.[41,51] HIPPS codes are used for home health payment risk adjustment[48,51] and identify home health patients as having little or no, moderate, or significant functional impairment and clinical severity. We characterized an individual as post-acute if they received inpatient acute or post-acute care in the 14 days prior to the home health episode.

Identified Need for Caregiver Training

Across seven activities, home health clinicians document whether an older adult needs family caregiver assistance, whether they receive this assistance, and whether the caregiver needs training/supervision in order to provide this assistance.[41] For each activity, we constructed a binary indicator of whether the family caregiver had an

identified need for training, limiting the sample to cases in which home health clinicians identified the older adult as both requiring and receiving family caregiver assistance with that activity. OASIS specifies the following seven activities: household chores, self-care tasks, medication management, medical procedures, equipment management, patient supervision, and advocacy. (See Appendix, section A1.1 for definitions of each activity.)

Statistical Analysis

We first assessed the proportion of family caregivers assisting during Medicare home health who had an identified need for training, both for any activity and by specific activity. Using the results of this analysis, as well as previous work characterizing rates of Medicare home health patients' identified need for caregiver assistance with each activity,[16] we identified four activities in which at least 50% of patients required caregiver assistance and at least 10% of caregivers providing assistance required training: household chores, self-care tasks, medication management, and patient supervision. We focused our analyses on these four activities to ensure sufficient sample size in both the treatment and comparison groups.

Within each of the four activities noted above, we described characteristics of older adults, stratified by whether their family caregiver did or did not need training. To test for differences between groups, we used weighted Satterthwaite Rao-Scott chi-square tests of independence for categorical variables and weighted t-tests for continuous variables. We then sought to understand whether and to what degree these observed associations were attenuated by older adult health and functional status during the

home health episode. (Greater clinical severity or functional impairment and the presence of cognitive impairment during home health were all positively associated with caregiver need for training across multiple caregiving activities; see Appendix, section A1.2, for these results.) We constructed logistic regression models to assess family caregiver need for training as a function of older adult characteristics and caregiving patterns prior to the home health episode. These models test each characteristic individually while adjusting for relevant health and functional status information gathered during the home health episode (older adult post-acute status, cognitive impairment, functional impairment, and clinical severity). All analyses used survey weights and design variables to account for non-probability sampling and to produce nationally representative estimates. Analyses were conducted using SAS version 9.4 (SAS Institute, Inc., Cary, NC).

3.4 Results

Of family caregivers assisting older home health patients with at least one care activity, 35.7% required training. The proportion of family caregivers who required training varied by activity from 8.6%, for training related to advocacy, to 48.2%, for training related to medical procedures (Figure 3.1). Medically-oriented activities, which include assisting with medical procedures, equipment management, and medication management, had the highest proportion of caregivers with an identified need for training (48.2%, 35.0%, and 29.1%, respectively). Identified need for training was also common among caregivers assisting with self-care (26.6%) and patient supervision (20.4%).

Whether family caregivers were identified as needing training during the home health episode varied little by older adult sociodemographic characteristics but varied significantly with respect to older adults' care needs prior to the home health episode. Caregivers were more likely to require training, across all caregiving activities, if they were assisting an older adult with lower care needs or a lower chronic illness burden prior to the home health episode.

Caregivers with an identified need for household chores training were more likely to be assisting an older adult who received fewer hours of caregiver assistance/month (62.7 hours vs 80.8 hours; p=0.03) and who had not previously received assistance with household, mobility, or self-care tasks (49.2% vs 38.9%; p=0.04) prior to home health (Table 3.1). After adjusting for older adult health and functional status during the home health episode, caregivers were more likely to need household chores training if assisting an older adult who did not have any chronic conditions (Adjusted Odds Ratio (aOR): 1.90; p<0.01) or receive assistance with household, mobility, or self-care tasks for health/function reasons (aOR: 1.74; p=0.01) prior to home health admission.

Caregivers with an identified need for self-care task training were more likely to be assisting an older adult who received fewer hours of caregiver assistance/month (68.7 hours vs 86.3 hours; p=0.02) prior to home health (Table 3.2). After adjusting for older adult health and functional status during the home health episode, caregivers were more likely to have an identified need for self-care task training if assisting an older adult who did not have any chronic conditions (aOR: 1.55; p<0.01), did not receive

assistance with household, mobility, or self-care tasks for health/function reasons (aOR: 1.45; p=0.03), or did not receive assistance with medication management (aOR: 1.59; p=0.02) prior to home health admission.

Caregivers with an identified need for medication management training were more likely to be assisting an older adult who received fewer hours of caregiver assistance/month (72.2 hours vs 89.8 hours; p=0.03) and had not previously received assistance with household, mobility, or self-care tasks (42.1% vs 33.4%; p=0.04) or medication management (83.6% vs 75.7%; p<0.01) prior to home health (Table 3.3). After adjusting for older adult health and functional status during the home health episode, caregivers were more likely to have an identified need for medication management training if assisting an older adult who did not have any chronic conditions (aOR: 1.44; p=0.01), did not receive assistance with household, mobility, or self-care tasks for health/function reasons (aOR: 1.60; p=0.01), or did not receive assistance with medication management (aOR: 2.14; p<0.001) prior to home health admission. Caregivers were less likely to have an identified need for medication management training if assisting an older adult who had a greater number of caregivers prior to home health (aOR:0.90; p=0.04).

Caregivers with an identified need for patient supervision training were less likely to be assisting an older adult who had a paid caregiver (12.2% vs 20.1%; p=0.01) and more likely to be assisting an older adult who had fewer caregivers (1.5 vs 1.8; p=0.02), who had not previously received assistance with household, mobility, or self-care tasks (45.0

vs 31.9%; p<0.01) or medication management (83.4% vs 75.6%; p=0.02) prior to home health (Table 3.4). After adjusting for older adult health and functional status during the home health episode, caregivers were more likely to have an identified need for patient supervision training if assisting an older adult who did not receive assistance with household, mobility, or self-care tasks for health/function reasons (aOR: 1.90; p<0.01) or did not receive assistance with medication management (aOR: 2.18; p<0.001) prior to home health admission. Caregivers were less likely to have an identified need for patient supervision training if assisting an older adult who had a greater number of caregivers prior to home health (aOR: 0.82; p<0.01).

3.5 Discussion

Home health clinicians identified more than one-third of family caregivers assisting during Medicare home health as requiring training related to their caregiving activities. Family caregivers' identified need for training was greatest for medically-oriented activities: nearly half of family caregivers assisting with medical procedures required training, while about one in three assisting with equipment or medication management required training. Caregivers were more likely to require training across multiple caregiving activities if they were assisting an older adult with fewer care needs prior to the home health episode. Findings suggest that there is significant need for training among family caregivers assisting during Medicare home health, that rates of need for training differ by caregiving activity, and that greater reliance on caregiver assistance prior to the home health episode is associated with family caregivers being better prepared and less in need of additional education.

We observed an inverse relationship between family caregiver training needs during home health and older adult care needs prior to home health: family caregivers were more likely to need training if assisting an older adult with lower care needs prior to home health. Though the mechanism underlying this relationship is not clear from our work, there are several likely explanations. It may be that older adults with greater pre-existing care needs have caregivers who have learned "on the job", developing expertise and confidence over the duration of their caregiving role, and are thus better positioned to assist. Additionally, it could be that older adults with pre-existing care needs have a greater number of caregivers, and are thus more likely to have at least one caregiver who is familiar with the necessary care activities during home health (e.g., at least one caregiver familiar with managing the older adult's medication regimen). Regardless, our findings indicate the relevance of understanding family caregivers' circumstances and what types of assistance they are accustomed to providing to guide referrals to caregiver training and supportive services.

We find that caregivers are more likely to need training if there has been a recent escalation in the older adult's care needs, such as those commonly observed during care transitions surrounding acute health events. During care transitions, family caregivers are often required to assist with new activities or provide more intensive support;[67-69] in particular, caregivers often assume greater responsibility for medically-oriented activities.[67] In our analyses, caregivers had the highest rates of need for training on medically-oriented activities and prior work has found that assisting with these activities is linked to greater caregiving intensity and burden.[70,71] There is already

wide acknowledgement of the need to improve provider engagement with family caregivers during care transitions.[37,72-74] Our findings suggest that these transitions may also offer an important opportunity to connect family caregivers with training resources.

As public payers, including Medicare, Medicaid, and Veterans Affairs (VA), expand access to community-based services,[75-78] and as demographic trends lead to more older adults aging in place with complex health and functional needs,[18,58,79] more older adults will experience significant shifts in care needs that occur wholly within the community. These changes are not care transitions in the traditional sense, but represent key inflection points in the care trajectory where access to training may be needed. The VA's Helping Invested Families Improve Veterans' Experiences Study (HI-FIVES) is an example of how access to training can be linked to changes in need that occur while the older adult ages in place.[25] Caregivers are approached for inclusion in HI-FIVES following an escalation in the older adult's use of home- and community-based long-term services and supports.[80] Integrated health care systems could similarly identify changes in utilization or referral patterns which indicate an intensification of the older adult's care needs and use these as opportunities to assess existing caregiver(s), offering training resources as appropriate. Improving access to training for these family caregivers may contribute to improved health outcomes and reduced utilization[10,26,27] for high-need, community-dwelling older adults.

Limitations

This work is subject to several limitations. First, we are constrained to the information available in the NHATS and OASIS and as a result, cannot determine whether the family caregivers evaluated in the OASIS were also providing assistance at the time of NHATS interview. However, it is reasonable to assume that one of the established caregivers identified in the NHATS would continue in their caregiving role during a home health episode occurring within one year. Second, measures of caregiver assistance and need for training during the home health episode are drawn from home health clinician reports in the OASIS. Research on the reliability and validity of OASIS items is generally sparse,[81] and no available research tests the psychometric properties of these measures in particular. Nonetheless, the OASIS represents the most comprehensive source of information on home health episodes nationwide. Third, we limit our sample to index home health episodes and therefore our findings may not be reflective of later episodes in a sustained period of home health utilization.

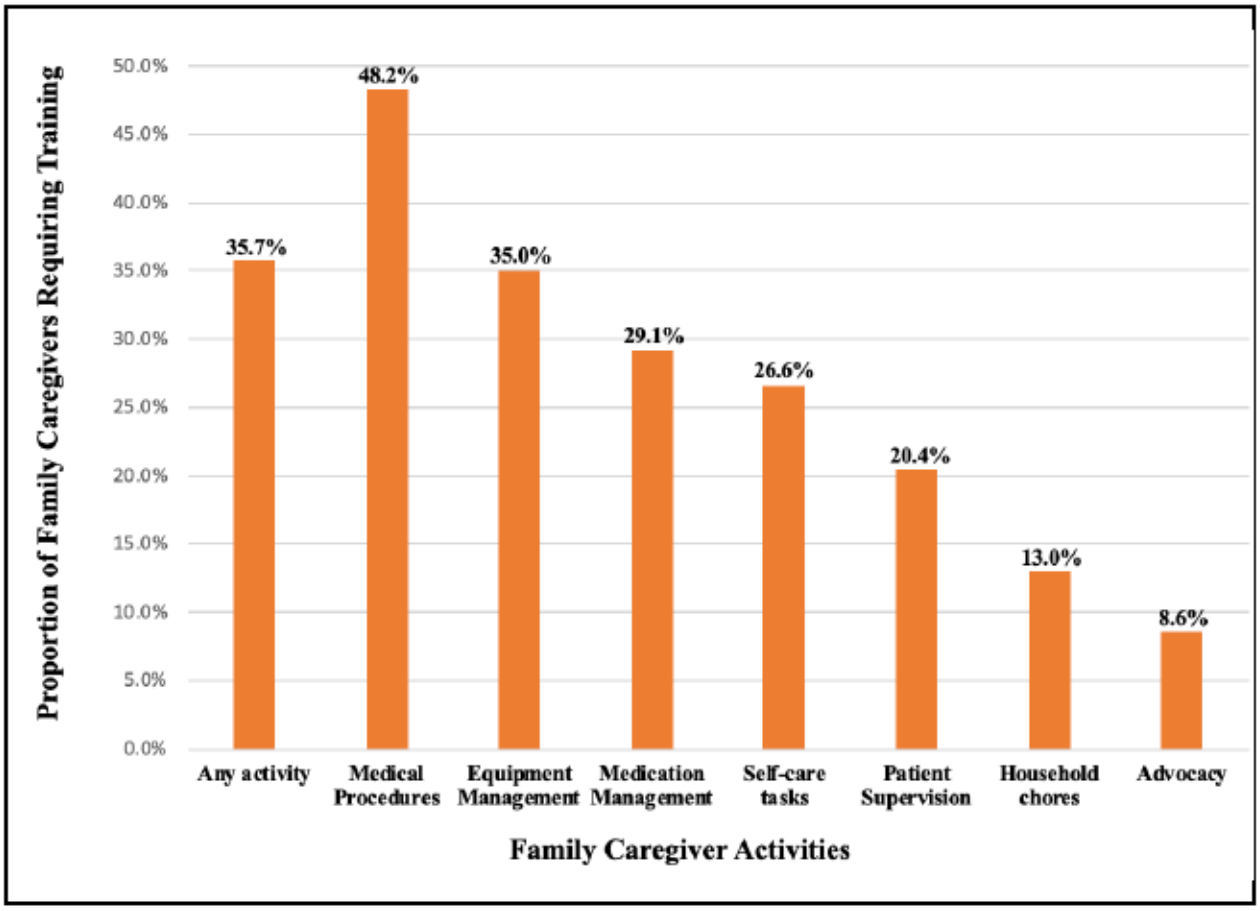
3.6 Conclusion

We found that a high proportion of family caregivers assisting during Medicare home health episodes are identified as needing activity-specific training and that rates of identified need for training vary by caregiving activity and older adult characteristics. Caregivers were more likely to require training during the home health episode if assisting an older adult who had experienced lower levels of previous assistance, suggesting that shifts in older adults' care needs may present important opportunities for providers to connect family caregivers with training supports, which can improve

well-being and outcomes for both family caregivers and older adults.[10,25-28] Future research is warranted which examines the relationship of family caregiver training to older adult health care utilization and outcomes in community settings.

Figures

Figure 3.1. Rates of Identified Need for Activity-Specific Training among Family Caregivers Assisting during Medicare Home Health*,†



* Data drawn from National Health and Aging Trends Study (NHATS) and linked Outcomes and Assessment Information Set (OASIS) data for 1,758 Medicare beneficiaries receiving family caregiver assistance during a home health episode between 2011-2016.

† Percentages weighted to account for National Health and Aging Trend Study (NHATS) survey design and produce nationally representative estimates.

Tables

Table 3.1. Characteristics of Older Adults Receiving Family Caregiver Assistance with Household Chores during Medicare Home Health and Family Caregiver Need for Training* (n=1,519 unweighted, n=7,126,800 weighted)

Older Adult Characteristics (measured prior to home health episode):	Family Caregiver Need for Training with Household Chores				
	No Need for Training *n (%)*	Need for Training *n (%)*	p-value	Adjusted Odds Ratio† (95% CI)	p-value
Age‡	79.4 (0.28)	79.7 (0.61)	0.59	1.00 (0.97, 1.03)	0.90
Female sex	830 (59.8)	112 (64.9)	0.25	1.37 (0.91, 2.06)	0.13
Non-white race	470 (21.3)	61 (20.9)	0.92	0.97 (0.66, 1.42)	0.88
Medicaid enrolled	268 (16.2)	32 (13.5)	0.39	0.79 (0.46, 1.37)	0.40
Medicare Advantage enrolled	391 (28.8)	53 (28.9)	0.97	0.96 (0.62, 1.51)	0.87
Education					
High school or less	851 (59.6)	116 (59.6)	0.99	REF	
Some college	474 (40.4)	65 (40.4)		1.05 (0.72, 1.53)	0.81
Lives alone	442 (32.2)	56 (33.1)	0.81	1.14 (0.80, 1.63)	0.48
Has paid caregiver	234 (16.2)	35 (14.0)	0.40	0.73 (0.46, 1.15)	0.17
Number of caregivers‡	1.6 (0.05)	1.5 (0.08)	0.41	0.90 (0.79, 1.02)	0.08
Hours/month of caregiver assistance	80.8 (4.3)	62.7 (6.4)	0.03	0.99 (0.99, 1.00)	0.29
Does not receive assistance with:					
Household tasks, mobility, or self-care	451 (38.9)	74 (49.2)	0.04	1.74 (1.15, 2.63)	0.01
Medication management	1037 (82.2)	142 (83.2)	0.77	1.50 (0.98, 2.31)	0.06
Does not have dementia	1016 (81.1)	142 (82.0)	0.77	1.37 (0.87, 2.14)	0.17
Does not have chronic conditions§	724 (62.6)	120 (75.2)	<0.01	1.90 (1.26, 2.85)	<0.01
Fell in past year	598 (44.3)	82 (44.7)	0.94	0.95 (0.65, 1.40)	0.79
Hospitalized in past year	442 (31.9)	58 (29.0)	0.49	0.83 (0.53, 1.28)	0.38

* Data are drawn from National Health and Aging Trends Study (NHATS) and linked Outcomes and Assessment Information Set (OASIS) data for 1,519 Medicare beneficiaries receiving family caregiver assistance with household chores during a home health episode between 2011-2016. Percentages are weighted to account for NHATS survey design and to produce nationally representative estimates.

† Odds of identified need for family caregiving training with household chores. Adjusted for characteristics measured during home health episode: post-acute entry into home health, cognitive impairment, functional impairment, and clinical severity.

‡ Mean, SE.

§ Chronic conditions include heart attack in previous year, heart disease, high blood pressure, diabetes, lung disease, and stroke in previous year.

Table 3.2. Characteristics of Older Adults Receiving Family Caregiver Assistance with Self-Care Tasks during Medicare Home Health and Family Caregiver Need for Training* (n=1,384 unweighted, n=6,480,207 weighted)

Older Adult Characteristics (measured prior to home health episode):	Family Caregiver Need for Training with Self-Care Tasks				
	No Need for Training *n (%)*	Need for Training *n (%)*	p-value	Adjusted Odds Ratio† (95% CI)	p-value
Age‡	79.1 (0.29)	80.4 (0.45)	<0.01	1.02 (0.99, 1.04)	0.07
Female sex	642 (60.0)	219 (61.6)	0.63	1.13 (0.84, 1.54)	0.41
Non-white race	380 (22.3)	110 (18.8)	0.25	0.78 (0.53, 1.15)	0.20
Medicaid enrolled	217 (16.9)	59 (12.9)	0.08	0.70 (0.46, 1.05)	0.08
Medicare Advantage enrolled	298 (27.9)	105 (30.9)	0.41	1.12 (0.79, 1.59)	0.50
Education					
High school or less	665 (60.0)	218 (58.8)	0.78	REF	
Some college	360 (40.0)	129 (41.2)		1.12 (0.77, 1.63)	0.54
Lives alone	312 (30.0)	117 (31.7)	0.64	1.15 (0.81, 1.65)	0.43
Has paid caregiver	185 (16.8)	68 (16.0)	0.70	0.83 (0.60, 1.16)	0.28
Number of caregivers‡	1.6 (0.06)	1.7 (0.09)	0.51	0.98 (0.87, 1.10)	0.71
Hours/month of caregiver assistance	86.3 (5.6)	68.7 (4.7)	0.02	0.99 (0.99,1.00)	0.29
Does not receive assistance with:					
Household tasks, mobility, or self-care	324 (37.0)	134 (43.4)	0.11	1.45 (1.05, 2.01)	0.03
Medication management	781 (81.0)	276 (82.7)	0.58	1.59 (1.06, 2.37)	0.02
Does not have dementia	767 (80.1)	274 (81.6)	0.58	1.49 (1.00, 2.21)	0.05
Does not have chronic conditions§	553 (62.6)	222 (70.9)	<0.01	1.55 (1.15, 2.08)	<0.01
Fell in past year	461 (44.7)	157 (44.1)	0.89	0.92 (0.65, 1.29)	0.61
Hospitalized in past year	339 (31.4)	120 (33.9)	0.44	1.09 (.83, 1.45)	0.52

* Data are drawn from National Health and Aging Trends Study (NHATS) and linked Outcomes and Assessment Information Set (OASIS) data for 1,384 Medicare beneficiaries receiving family caregiver assistance with self-care tasks during a home health episode between 2011-2016. Percentages are weighted to account for NHATS survey design and to produce nationally representative estimates.

† Odds of identified need for family caregiving training with self-care tasks. Adjusted for characteristics measured during home health episode: post-acute entry into home health, cognitive impairment, functional impairment, and clinical severity.

‡ Mean, SE.

§ Chronic conditions include heart attack in previous year, heart disease, high blood pressure, diabetes, lung disease, and stroke in previous year.

Table 3.3. Characteristics of Older Adults Receiving Family Caregiver Assistance with Medication Management during Medicare Home Health and Family Caregiver Need for Training* (n=1,217 unweighted, n=5,578,439 weighted)

Older Adult Characteristics (measured prior to home health episode):	Family Caregiver Need for Training with Medication Management				
	No Need for Training *n (%)*	Need for Training *n (%)*	p-value	Adjusted Odds Ratio† (95% CI)	p-value
Age‡	80.1 (0.31)	79.6 (0.47)	0.25	0.99 (0.97, 1.01)	0.31
Female sex	534 (56.5)	200 (61.6)	0.18	1.24 (0.89, 1.72)	0.19
Non-white race	317 (21.4)	117 (22.1)	0.83	1.01 (0.68, 1.51)	0.95
Medicaid enrolled	185 (16.6)	71 (18.1)	0.61	1.06 (0.70, 1.60)	0.80
Medicare Advantage enrolled	248 (27.2)	103 (30.8)	0.34	1.18 (0.81, 1.70)	0.38
Education					
High school or less	581 (60.9)	221 (62.4)	0.71	REF	
Some college	295 (39.1)	108 (37.6)		0.98 (0.68, 1.43)	0.93
Lives alone	259 (28.5)	115 (33.9)	0.07	1.34 (1.01, 1.78)	0.04
Has paid caregiver	177 (18.2)	61 (16.9)	0.65	0.83 (0.57, 1.23)	0.35
Number of caregivers‡	1.7 (0.06)	1.6 (0.08)	0.25	0.90 (0.81, 0.99)	0.04
Hours/month of caregiver assistance	89.8 (5.8)	72.2 (5.4)	0.03	1.00 (0.99, 1.00)	0.28
Does not receive assistance with:					
Household tasks, mobility, or self-care	246 (33.4)	125 (42.1)	0.04	1.60 (1.11, 2.28)	0.01
Medication management	625 (75.7)	260 (83.6)	<0.01	2.14 (1.53, 2.99)	<0.001
Does not have dementia	622 (76.0)	255 (81.0)	0.12	1.64 (1.10, 2.45)	0.02
Does not have chronic conditions§	478 (62.7)	200 (69.4)	0.02	1.44 (1.10, 1.90)	0.01
Fell in past year	405 (45.3)	143 (42.6)	0.49	0.85 (0.61, 1.18)	0.31
Hospitalized in past year	285 (31.1)	113 (33.2)	0.53	1.03 (0.77, 1.38)	0.85

* Data are drawn from National Health and Aging Trends Study (NHATS) and linked Outcomes and Assessment Information Set (OASIS) data for 1,217 Medicare beneficiaries receiving family caregiver assistance with medication management during a home health episode between 2011-2016. Percentages are weighted to account for NHATS survey design and to produce nationally representative estimates.

† Odds of identified need for family caregiving training with medication management. Adjusted for characteristics measured during home health episode: post-acute entry into home health, cognitive impairment, functional impairment, and clinical severity.

‡ Mean, SE.

§ Chronic conditions include heart attack in previous year, heart disease, high blood pressure, diabetes, lung disease, and stroke in previous year.

Table 3.4. Characteristics of Older Adults Receiving Family Caregiver Assistance with Patient Supervision during Medicare Home Health and Family Caregiver Need for Training* (n=1,061 unweighted, n=4,870,844 weighted)

Older Adult Characteristics (measured prior to home health episode):	Family Caregiver Need for Training with Patient Supervision				
	No Need for Training *n (%)*	Need for Training *n (%)*	p-value	Adjusted Odds Ratio† (95% CI)	p-value
Age‡	80.0 (0.33)	79.6 (0.58)	0.48	0.99 (0.96, 1.01)	0.25
Female sex	541 (58.5)	79 (39.1)	0.69	1.11 (0.67, 1.85)	0.69
Non-white race	323 (22.2)	128 (78.9)	0.73	0.91 (0.61, 1.36)	0.64
Medicaid enrolled	194 (18.5)	37 (14.3)	0.19	0.73 (0.43, 1.24)	0.24
Medicare Advantage enrolled	241 (26.1)	64 (34.5)	0.10	1.39 (0.88, 2.19)	0.16
Education					
High school or less	585 (62.3)	122 (62.4)	0.99	REF	
Some college	274 (37.7)	69 (37.6)		1.04 (0.69, 1.57)	0.86
Lives alone	258 (29.7)	65 (32.1)	0.56	1.15 (0.77, 1.71)	0.50
Has paid caregiver	181 (20.1)	30 (12.2)	0.01	0.49 (0.29, 0.82)	<0.01
Number of caregivers‡	1.8 (0.06)	1.5 (0.09)	0.02	0.82 (0.71, 0.93)	<0.01
Hours/month of caregiver assistance	89.7 (5.0)	72.3 (6.6)	0.08	1.00 (0.99, 1.00)	0.69
Does not receive assistance with:					
Household tasks, mobility, or self-care	235 (31.9)	76 (45.0)	<0.01	1.90 (1.31, 2.76)	<0.01
Medication management	607 (75.6)	150 (83.4)	0.02	2.18 (1.44, 3.30)	<0.001
Does not have dementia	597 (75.0)	145 (79.2)	0.25	1.58 (1.01, 2.46)	0.04
Does not have chronic conditions§	474 (64.4)	121 (70.8)	0.12	1.36 (0.89, 2.07)	0.15
Fell in past year	394 (45.1)	80 (39.4)	0.24	0.75 (0.49, 1.14)	0.17
Hospitalized in past year	290 (32.3)	63 (31.7)	0.87	0.95 (0.64, 1.42)	0.80

* Data are drawn from National Health and Aging Trends Study (NHATS) and linked Outcomes and Assessment Information Set (OASIS) data for 1,061 Medicare beneficiaries receiving family caregiver assistance with patient supervision during a home health episode between 2011-2016. Percentages are weighted to account for NHATS survey design and to produce nationally representative estimates.

† Odds of identified need for family caregiving training with patient supervision. Adjusted for characteristics measured during home health episode: post-acute entry into home health, cognitive impairment, functional impairment, and clinical severity.

‡ Mean, SE.

§ Chronic conditions include heart attack in previous year, heart disease, high blood pressure, diabetes, lung disease, and stroke in previous year.

CHAPTER FOUR: EFFECTS OF FAMILY CAREGIVER TRAINING NEEDS ON MEDICARE HOME HEALTH CARE

4.1 Abstract

Background: Recent changes to Medicare Home Health Conditions of Participation mandate that providers offer family caregiver training; however, there is little information regarding the impact of family caregiver training on home health care intensity. A better understanding of this relationship is necessary to inform development and prioritization of caregiver training interventions in this setting.

Objectives: To assess whether and how family caregiver need for training affects care intensity during Medicare home health.

Methods: A retrospective observational study of 1,217 (weighted n=5,870,905) fee-for-service Medicare beneficiaries who participated in the National Health and Aging Trends Study (NHATS) between 2011-2015 and received Medicare-funded home health care within one year of survey. We use propensity score adjusted, multivariable logistic and negative binomial regressions to model the relationship between family caregiver need for activity-specific training and the number/type of visits received during Medicare home health. Primary outcomes include number and types of home health visits, from Medicare claims. Primary predictor variables are family caregivers' identified need for activity-specific training, from home health patient assessment data.

Results: Older adults whose family caregiver had an identified need for training on self-care tasks had greater odds of receiving any therapy visits (aOR: 1.70; 95% CI: 1.01,

2.86), aide visits (aOR: 2.12; 95% CI: 1.11, 4.05), or training visits (aOR: 1.49; 95% CI:1.01, 2.21). Older adults whose family caregiver had an identified need for training on medication management had greater odds of receiving any nursing visits (aOR: 3.03; 95% CI: 1.06, 8.68) and incurred 1.06 (95% CI: 0.11, 2.01) additional nursing visits.

Conclusions: During Medicare home health episodes, older adults receive a greater number of visits if their family caregiver requires training. Findings indicate that health care providers are responsive to caregiver capacity when determining service delivery and care intensity.

4.2 Introduction

Given family and unpaid caregivers' significant contributions to providing care for older adults,[10] as well as the increasing involvement of family caregivers in assisting with medical and nursing activities,[3] there is growing interest in understanding how family caregiver factors influence health care utilization, costs, and outcomes for older adults.[5-13] These questions may be especially relevant in the context of Medicare-funded home health care, in which eligible beneficiaries receive skilled nursing, therapy, and personal care aide services in their homes. Due to intermittent staff presence in the home and the significant medical and social vulnerability of their patient population, Medicare home health providers often rely on family caregivers to help meet patients' care needs. In 87% of Medicare-funded home health episodes, clinicians report a need for family caregiver assistance in addition to care provided by home health staff.[62]

In light of family caregivers' frequent involvement in home health care, and evidence that the majority of family caregivers do not receive training or feel prepared for their caregiving role,[10,16] the Centers for Medicare and Medicaid Services (CMS) recently revised the Medicare Home Health Conditions of Participation to require that providers offer family caregiver training.[24] However, there is limited information available regarding the potential effects of caregiver training on home health processes or outcomes and scant guidance for home health providers regarding creation and implementation of family caregiver training interventions. Prior studies of family caregiver training have been limited to the ambulatory setting and have largely assessed the effects of training for the caregiver, rather than the older adult.[25,27-31]

A better understanding of how family caregivers' training needs affect Medicare home health care is needed at this juncture to inform providers' efforts to comply with the new CMS training mandate, to help home health providers practice patient- and family-centered care by prioritizing activity-specific training interventions, and to add to the emerging body of literature examining family caregivers' impact on health care for older adults. This study provides the first information regarding the effect of family caregiver need for training on care processes—specifically, visit type and intensity—during a Medicare home health episode. We examine visit type and intensity because visits are the basic unit of home health care and clinicians base decisions regarding visit structure in part on available support in the home, including family caregiver factors.[82-84] Moreover, visit type and intensity are the largest drivers of variable costs for home health providers[85] and an important determinant of profit margins.[86]

This study relies on a novel dataset linking nationally representative survey data with Medicare claims and patient assessments. Using doubly robust, propensity score adjusted statistical models, we model the relationship between family caregiver need for activity-specific training and home health visit type and intensity. Findings are relevant to ongoing efforts by providers and policymakers to better support family caregivers of older adults and to understand how family caregiver factors affect health care utilization for this population.

4.3 Methods

Data Sources and Analytic Sample

Data for this study were drawn from four linked data sources: the National Health and Aging Trends Study (NHATS), the Outcomes and Assessment Information Set (OASIS), Medicare claims, and Medicare Provider of Services (POS) files. NHATS is an annual, nationally representative survey of Medicare beneficiaries ages 65 and older that collects comprehensive information on participants' sociodemographic characteristics, health and functional status, and assistance from family and unpaid caregivers via in-person interviews. OASIS is a standardized patient assessment completed by home health staff (either a Registered Nurse (RN) or Physical Therapist (PT)) and submitted to CMS at regular intervals during a Medicare-funded home health episode. OASIS includes information regarding the older adult's clinical and functional status, plan of care, and receipt of family caregiver assistance. POS files are publicly-available sources of information on the characteristics of Medicare-certified providers, including home health providers.

The analytic sample includes 1,217 older adults who participated in the 2011 NHATS and received Medicare-funded home health within one year of the baseline interview (2011) or a subsequent interview (2012-2015). We pooled NHATS data from 2011-2015 with linked OASIS data and Medicare claims from 2011-2016. For each participant, we matched the OASIS Start of Care filing for the first (index) home health episode during the observation period with the NHATS interview immediately preceding the index home health episode. We then included claims filed for services provided during the 60-day

index home health episode. Finally, we used CMS Certification Numbers (unique identifiers assigned to each Medicare-certified provider) present in the claims to link to POS data for each provider from the year in which the index episode occurred.

We examined only the index home health episode; therefore, each participant appears in the dataset only once. We excluded NHATS participants who did not receive any home health care during the observation period as well as those living in congregate settings such as assisted living facilities at the time of the NHATS interview due to the availability of supports that may substitute for or otherwise affect family caregiving. Additionally, our sample includes Medicare fee-for-service enrollees but excludes Medicare Advantage enrollees, given the availability of claims data.

Measures

Older Adult and Home Health Provider Characteristics

From NHATS, we drew measures of older adults' sociodemographic characteristics (age, sex, race, Medicaid-enrollment), receipt of family caregiver assistance (number of caregivers, types of caregiving assistance received), living arrangement (whether they live alone), and health status (fallen in past year, self-reported overall health) prior to home health. Types of caregiver assistance received include any assistance with household, mobility, or self-care tasks due to issues with health or function or assistance with medication management.

From OASIS, we drew measures of older adults' living arrangement (whether they live alone), post-acute status (whether they received inpatient care within 14 days of home health care), treatments received (any respiratory or intravenous therapy), clinical severity (overall clinical severity, presence of pressure ulcer, presence of surgical wound), functional impairment, and cognitive impairment during home health. Functional impairment and overall clinical severity during the home health episode are determined from Health Insurance Prospective Payment System (HIPPS) codes.[51] These codes are used for home health payment risk adjustment[51] and identify home health patients as having little or no, moderate, or significant functional impairment and low, moderate, or significant clinical severity. Cognitive impairment was measured via home health clinician assessment of the older adult.[41] Older adults were considered to have no cognitive impairment if the home health clinician noted that they were "alert and oriented…comprehend and recall task direction independently" and some cognitive impairment otherwise.[41] From POS, we drew a measure of whether the home health provider is nonprofit, defined as a nongovernmental agency which is exempt from Federal Income taxation pursuant to section 501 of the Internal Revenue Code of 1954.[52]

Family Caregiver Need for Training

In OASIS, home health clinicians document whether an older adult needs family caregiver assistance with specific activities, whether they receive this assistance, and whether the caregiver needs training/supervision in order to provide this assistance.[41] For each activity, we constructed a binary indicator of whether the family caregiver had

an identified need for training, limiting the sample to cases in which home health clinicians identified the older adult as both requiring and receiving family caregiver assistance with that activity. We considered four caregiving activities specified in the OASIS: activities for which at least 50% of older adults were assessed as requiring family caregiver assistance[62] and at least 10% of caregivers had an identified need for training.[87] These four activities are household chores, self-care tasks, medication management, and patient supervision.

Number and Type of Home Health Visits

Medicare home health is reimbursed and delivered in 60-day episodes of care.[48] (Note: beginning January 1, 2020 reimbursement periods have been shortened to 30 days.[49]) During a home health episode the patient may receive varying numbers of visits from home health staff and these visits may include a mix of skilled nursing, skilled therapy, personal care aide, and other service types. Visit type and intensity are major determinants of profit margins for home health providers[85,86] and prior qualitative work suggests that caregiver factors influence home health nurse decisions regarding the number and type of visits provided.[82-84]

Using Medicare claims, we derived counts of home health visits provided within the 60-day index home health episode. We created count variables for number of nursing, therapy, aide, training, and total visits incurred in this timeframe, identifying the type of visit using Healthcare Common Procedure Coding System (HCPCS) codes.[47,50] Nursing visits include visits from a Registered Nurse (RN) or Licensed Practical Nurse (LPN) to

provide direct care, evaluate the plan of care, or observe/assess patient's condition. Therapy visits include visits from a Physical Therapist (PT), Occupational Therapist (OT), Speech Language Therapist, or PT or OT Assistant to provide direct care or develop a program of therapy. Personal care aide visits include visits from a Home Health Aide. Training visits include visits from an RN or LPN to offer training/education to patients or family members. We calculated total visits by summing the number of reported nursing, therapy, aide, and training visits.

Statistical Analysis

Propensity Score Adjustment

There are a number of underlying patient characteristics that could confound the relationship between caregiver need for training and the type/intensity of home health care received by the patient. To address this threat, we use propensity score adjustment to yield treatment and comparison groups that are balanced with regard to observed characteristics, allowing for an unbiased estimation of treatment effect, assuming no unmeasured confounders.[53] For each caregiving activity category, we used logistic regression to model individuals' probability of having a caregiver with an identified need for training (the "treatment") as a function of a range of potential confounders observed prior to home health—including measures of older adult sociodemographic characteristics, health status, caregiver availability, and types of caregiver assistance received prior to home health.

We adjusted for each individual's propensity score using weighting by the odds: treated individuals receive a weight of 1 and untreated individuals receive a weight of e/(1-e), where e represents the individual's propensity score.[55,56] In order to adjust for each individual's probability of treatment (propensity score) while simultaneously accounting for the complex survey design and producing nationally representative estimates, we created composite weights equal to the product of each individual's propensity score weight and NHATS survey weight, an approach that has been described and validated in prior literature,[54,55,88,89] and truncated outlier weights to the 99th and 1st percentiles.[54,55]

We then calculated the standardized differences in means of observed covariates between treatment and comparison groups, both before and after propensity score adjustment. Following propensity score adjustment all standardized differences were less than 10%, indicating satisfactory covariate balance between treated and comparison groups when using composite weights.[56] These composite weights were used in our final analyses.

Regression Models

Multivariable, weighted logistic regression models were used to model the odds of receiving any nursing, therapy, aide, or training visits during a Medicare home health episode, as a function of family caregivers' identified need for activity-specific training. Multivariable, weighted negative binomial regressions were used to model the expected number of total, nursing, therapy, aide, or training visits during a Medicare home health

episode, as a function of family caregivers' identified need for activity-specific training. Due to a high frequency of 0 counts for therapy, aide, and training visits, zero-inflated negative binomial models were used to model the expected number of these visit types. (See Appendix 2, Table A5, for proportion receiving zero visits, by visit type.)

All models adjust for older adults' sociodemographic characteristics (age, sex, race, Medicaid enrollment), receipt of family caregiver assistance (number of caregivers, types of caregiving assistance received), living arrangement (whether they live alone), and health status (fallen in past year, self-reported overall health) prior to home health, older adults' living arrangement (whether they live alone), post-acute status (whether they received inpatient care within 14 days of home health care), treatments received (any respiratory or intravenous therapy), clinical severity (overall clinical severity, presence of pressure ulcer, presence of surgical wound), functional impairment, and cognitive impairment during home health, and home health provider nonprofit status. All models are weighted using composite weights to adjust for both propensity score and complex survey design. All analyses were performed using Stata 14 (StataCorp LLC, College Station, TX).

4.4 Results

Among community-dwelling older adults receiving family caregiver assistance during home health care, 40.5% were male, 19.6% were non-white, and 16.7% were Medicaid-enrolled (Table 4.1). Prior to home health, the proportion of study participants receiving self-care assistance was 25.4% and the proportion reporting fair/poor health was 41.9%. During home health, 32.4% had high clinical severity, 20.4% had high functional

impairment, and 44.1% had cognitive impairment. The average number of total visits received during the 60-day episode was 16.9.

Older adults whose family caregiver required training on household chores had greater odds of receiving any nursing visits (Adjusted Odds Ratio (aOR): 3.38; 95% confidence interval (95% CI): 1.33, 8.59) or aide visits (aOR: 3.54; 95% CI: 1.82, 6.92; Table 4.2). Older adults whose family caregiver required training on self-care tasks had greater odds of receiving any therapy visits (aOR: 1.70; 95% CI: 1.01, 2.86), aide visits (aOR: 2.12; 95% CI: 1.11, 4.05), or training visits (aOR: 1.49; 95% CI:1.01, 2.21). Older adults whose family caregiver required training on medication management had greater odds of receiving any nursing visits (aOR: 3.03; 95% CI: 1.06, 8.68).

Older adults whose family caregiver required training on household chores incurred 3.24 (95% CI: 0.21, 6.28) additional total visits and 1.32 (95% CI: 0.36, 2.27) additional aide visits (Table 4.3). Older adults whose family caregiver required training on medication management incurred 1.06 (95% CI: 0.11, 2.01) additional nursing visits. Family caregiver need for training, across all caregiving activities, did not significantly affect the number of training visits received. (See Appendix 2, Tables A6-A13, for full regression results.)

Sensitivity Analyses

Given that our treated and comparison groups exhibited relatively good balance on observed covariates even prior to propensity score adjustment (See Chapter 2, table

2.4), we duplicated all regression analyses, as described above, without propensity score adjustment. We found that the direction and strength of observed relationships did not vary greatly. However, several findings that were statistically significant when adjusting for survey design and propensity score were no longer statistically significant when adjusting only for survey design, suggesting that observed potential confounders did attenuate these relationships. Observed relationships that remained statistically significant without propensity score adjustment included: family caregiver need for training on household chores or self-care tasks and greater odds of receiving any aide visits, family caregiver need for training on household chores and greater number of total visits and aide visits, and family caregiver need for training on medication management and greater number of nursing visits. (See Appendix 2, Tables A14 and A15, for these results.)

Propensity score adjustment provides unbiased estimates under the assumption that there are no unobserved confounders; a range of sensitivity analyses can be used to examine the sensitivity of the results to violation of this assumption.[90] Following an approach developed by Greenland (1996)[57] we estimated the relationship of interest (as an odds ratio with 95% confidence interval) between family caregiver need for activity-specific training and odds of receiving any nursing, therapy, aide, or training visits, while adjusting for a potential unobserved confounder. We found that all parameter estimates from our adjusted logistic regressions were within the 95% confidence intervals for the "true" relationships estimated by our sensitivity analysis. There was one exception: when the prevalence of the unobserved confounder in the untreated population was set

at 20%, the estimated odds ratio for the relationship between caregiver need for training on household chores and the odds of receiving any training visits is no longer within the 95% confidence interval of the estimated true relationship. (See Appendix 2, Table A16, for these results.)

4.5 Discussion

Among Medicare beneficiaries receiving family caregiver assistance during a home health episode, family caregivers' identified need for activity-specific training was associated with greater visit intensity during the episode. Older adults whose family caregivers had an identified need for training on household chores, self-care tasks, or medication management experienced a greater number of aide, therapy, and nursing visits, respectively. Findings demonstrate that family caregiver factors—specifically, need for training— affect care intensity and resource utilization during Medicare home health, lending support to ongoing policy efforts to improve family caregiver access to training[24] and raising the possibility that investing in family caregiver training could be cost-effective at a systems-level.

There is a growing body of literature dedicated to understanding how family caregiving may influence older adults' health care utilization.[5-8,12,13] Previous studies have found associations between family caregiver factors and skilled nursing facility entry,[8,12] as well as emergent care utilization.[6] While previous studies have examined the impact of family caregiver presence on home health access,[34,91] this is the first study to test for relationships between specific family caregiver factors and utilization during a home

health episode. Additionally, previous work has measured health care utilization in two ways: by binary measures of access/admission[6,8,12,91] and by health care spending.[7,92] This study assesses the impact of family caregiver factors on intensity of care delivery within a specific health care setting and therefore may hold greater relevance for clinical and policy intervention. We model the relationship between a previously unexamined caregiver factor (need for training) and a previously unexamined utilization outcome (intensity of care received during home health), finding that caregiver need for training is related to greater intensity of home health care.

Using projected national average per-visit payment amounts for Medicare home health in 2020, we are able to estimate the cost to Medicare of the additional visits associated with family caregiver need for training. Patients whose family caregiver had an identified need for training on household chores incurred 1.32 additional aide visits, leading to an additional per-episode cost of $89.47 ($67.78*1.32).[93] Those whose family caregiver needed training on medication management incurred 1.06 additional nursing visits, leading to an additional per-episode cost of $158.66 ($149.68*1.06).[93] Multiplied across home health episodes in which family caregivers have an identified need for training, we estimate that family caregiver need for training on household chores and medication management cost Medicare an additional $33.5 million and $102.3 million annually, respectively. (See Appendix 2, Table A17 for calculations.) These are preliminary estimates, and a more detailed analysis is warranted to precisely determine the impact of family caregiver need for training on Medicare home health spending. However,

these figures illustrate the potential cost implications of family caregiver capacity and identified need for training in this setting.

The observed relationships between family caregiver need for training and visit type/intensity during home health have relevance for researchers and advocates currently working to design, implement, and test care delivery interventions, as they suggest another potential avenue to bring value to care delivery through better support of family caregivers. The preponderance of existing literature surrounding family caregiver training interventions assesses the success of these programs via caregiver-reported outcomes (e.g. depressive symptoms, burden, sense of self-efficacy related to caregiving)[25,27-29,31] and older adult quality of life and function.[25,80] Our findings suggest that measures of health care utilization, particularly the intensity of home- and community-based services, may be relevant outcomes to study when evaluating caregiver training interventions. Such measures merit consideration when seeking to understand the complex pathways through which supporting family caregivers may affect care delivery for older adults.

The lack of significant relationships between caregiver need for training and the likelihood of receiving training visits or the number of training visits provided is initially counterintuitive. Although it is reasonable to expect that home health clinicians would act on identified training needs by delivering training visits, substantial structural barriers exist. Given the episodic nature of home health reimbursement[48,94] and the fact that variable costs are largely driven by the number of visits,[85] home health providers incur

lower margins when delivering a greater number of visits per episode.[86] This creates a financial incentive to carefully control the amount of time clinicians spend with each patient and direct patient care must take priority over training. Additionally, caregiver training implementation studies have been limited to the ambulatory setting[25,27,30,31] and little information is available to guide home health providers in providing family caregiver training.

Home health is not unique in having notable obstacles to family caregiver training. Across the health care system, structural factors including narrow reimbursement opportunities for time spent interacting with caregivers,[15,73] limited professional preparation related to caregiver training,[14] and a lack of scalable caregiver assessment tools/training programs specific to a given care delivery setting[10] make it difficult for clinicians to incorporate family caregiver training into existing care practices. Greater investment, in the forms of new reimbursement opportunities or funding of small-scale pilot training intervention programs, could help improve access to training. However, given ongoing concerns regarding health care spending, an evidence base demonstrating potential cost-effectiveness and benefits to caregivers/older adults is necessary to motivate such investments. Although far from conclusive, our findings suggest a possible role for caregiver training interventions to contribute to more efficient care delivery. Additional research is warranted which explores the possibility for family caregiver training programs to offset costs for payers like Medicare.

Limitations

Although this work presents a rigorous approach to measuring the effect of family caregiver need for training on home health care intensity, findings are subject to several limitations. Due to our reliance on claims data to ascertain home health visit type and intensity, our sample is limited to Medicare Fee-for-Service enrollees only and findings may not be applicable to Medicare Advantage enrollees. We rely on the OASIS for measures of caregiver need for activity-specific training. OASIS is the only available national source of data on family caregiver factors during home health; however, research on the reliability and validity of OASIS items is generally sparse[81] and no available research tests the psychometric properties of these measures in particular. While propensity score adjustment minimizes the threat of endogeneity, it cannot eliminate this threat entirely and does not account for unobserved potential confounders, although our sensitivity analysis probes this limitation directly. Finally, due to our reliance on the NHATS our sample size is constrained which may affect tests of statistical significance; further research is warranted which draws on additional years of NHATS/OASIS data.

4.6 Conclusion

During Medicare home health episodes, older adults receiving family caregiver assistance receive a greater number of visits if their family caregiver has an identified need for training. Findings strengthen the growing body of evidence demonstrating that family caregiver factors impact older adults' health care utilization and growing calls for expanded efforts to better support family caregivers by clinicians and other health care workers.

Tables

Table 4.1. Characteristics of Community-Dwelling Older Adults Receiving Medicare Home Health between 2011-2016 (n=1,217 unweighted, n=5,870,905 weighted)*

Characteristic	% (*n*) or Mean ± *SE*
Family caregiver needs training with:†	
Household chores	12.7% *(126)*
Self-care	26.1% *(249)*
Medication management	27.7% *(230)*
Patient supervision	19.2% *(136)*
Number of home health visits, by visit type:	
Total visits	16.9 ± 0.47
Nursing visits	7.2 ± 0.26
Therapy visits	8.1 ± 0.32
Aide visits	1.6 ± 0.17
Training visits	1.4 ± 0.14
Older Adult Characteristics	
Age	79.8 ± 0.29
Male sex	40.5% *(468)*
Non-white race	19.6% *(401)*
Medicaid-enrolled	16.7% *(250)*
Prior to Home Health	
Number of caregivers	1.6 ± 0.06
Receives assistance with medication management	16.8% *(260)*
Receives functional assistance with:	
None	40.1% *(421)*
Household chores	27.1% *(318)*
Mobility	7.4% *(109)*
Self-care	25.4% *(369)*
Lives alone	34.8% *(438)*
Fallen in past year	44.6% *(547)*
Self-rated health:	
Excellent/very good	26.4% *(285)*
Good	31.7% *(381)*
Fair/poor	41.9% *(551)*
During Home Health	
Lives alone	32.8% *(400)*
Post-acute	71.0% *(794)*
Receives any respiratory therapy	10.5% *(137)*
Receives any IV therapy	2.1% *(24)*
Clinical severity	
Low	26.5% *(331)*
Moderate	41.1% *(485)*
High	32.4% *(401)*
Functional impairment	
None/low	17.2% *(190)*
Moderate	62.4% *(762)*

High	20.4% *(265)*
Cognitive impairment	44.1% *(605)*
Pressure ulcer	3.0% *(46)*
Wound	25.8% *(253)*
Home Health Provider Characteristics	
Nonprofit	46.2% *(455)*

* Data are drawn from National Health and Aging Trends Study (NHATS) and linked Outcomes and Assessment Information Set (OASIS) and Medicare claims data for 1,217 Medicare beneficiaries receiving family caregiver assistance during a home health episode between 2011-2016. Percentages are weighted to account for NHATS survey design and to produce nationally representative estimates.

† Need for training among family caregivers assisting with each activity during the Medicare home health episode. Family caregiver need for training is identified and reported by the home health clinician.

Table 4.2. Effect of Family Caregiver's Need for Activity-Specific Training on Odds of Receiving Visits during a Medicare Home Health Episode, by visit type (n=1,217 unweighted, n=5,870,905 weighted)*

	Home Health Visit Type							
	Nursing Visits		Therapy Visits		Aide Visits		Training Visits	
	aOR† (95% CI)	p-value	aOR (95% CI)	p-value	aOR (95% CI)	p-value	aOR (95% CI)	p-value
Family caregiver needs training with:								
Household chores	3.38 (1.33, 8.59)	0.01	1.01 (0.53, 1.90)	0.98	3.54 (1.82, 6.92)	<0.001	1.18 (0.71, 1.96)	0.52
Self-care	1.33 (0.73, 2.43)	0.35	1.70 (1.01, 2.86)	0.04	2.12 (1.11, 4.05)	0.02	1.49 (1.01, 2.21)	0.04
Medication management	3.03 (1.06, 8.68)	0.04	0.98 (0.54, 1.78)	0.94	1.08 (0.59, 1.98)	0.81	1.42 (0.94, 2.17)	0.10
Patient supervision	1.63 (0.59, 4.54)	0.34	1.52 (0.81, 2.82)	0.19	1.15 (0.56, 2.39)	0.69	1.23 (0.73, 2.05)	0.43

* Data are drawn from National Health and Aging Trends Study (NHATS) and linked Outcomes and Assessment Information Set (OASIS) and Medicare claims data for 1,217 Medicare beneficiaries receiving family caregiver assistance during a home health episode between 2011-2016. Models are weighted for propensity score adjustment and to account for NHATS survey design.

† Adjusted Odds Ratio. Adjusted for: older adults' sociodemographic characteristics (age, sex, race, Medicaid enrollment), receipt of caregiver assistance (number of caregivers, help with medications, level of functional assistance), and health and functional status (fallen in prior year, self-rated overall health) prior to home health, older adults' health and functional status (clinical severity, post-acute status, functional impairment, cognitive impairment, receipt of any respiratory or IV therapies, presence of ulcer or wound), and home health provider nonprofit status.

Table 4.3. Effect of Family Caregiver's Need for Activity-Specific Training on Expected Number of Additional Visits during a Medicare Home Health Episode, by visit type (n=1,217 unweighted, n=5,870,905 weighted)*,†

	Home Health Visit Type									
	Total Visits		Nursing Visits		Therapy Visits		Aide Visits		Training Visits	
	Add'l visits (95% CI)	p-value	Add'l visits (95% CI)	p-value	Add'l visits (95% CI)	p-value	Add'l visits (95% CI)	p-value	Add'l visits (95% CI)	p-value
Family caregiver needs training with:										
Household chores	3.24 (0.21, 6.28)	0.04	1.11 (-0.22, 2.44)	0.10	0.26 (-1.51, 2.04)	0.77	1.32 (0.36, 2.27)	0.008	-0.08 (-0.68, 0.53)	0.80
Self-care	1.65 (-0.65, 3.96)	0.16	-0.16 (-1.13, 0.82)	0.75	0.97 (-0.32, 2.25)	0.14	0.72 (-0.09, 1.52)	0.08	0.43 (-0.07, 0.93)	0.09
Medication management	0.60 (-1.10, 2.30)	0.48	1.06 (0.11, 2.01)	0.03	-0.39 (-1.53, 0.75)	0.50	-0.23 (-1.04, 0.59)	0.58	0.29 (-0.27, 0.84)	0.30
Patient supervision	0.06 (-2.26, 2.38)	0.96	0.85 (-0.32, 2.03)	0.15	-0.77 (-2.53, 0.99)	0.38	-0.19 (-0.96, 0.58)	0.63	0.09 (-0.46, 0.64)	0.75

* Data are drawn from National Health and Aging Trends Study (NHATS) and linked Outcomes and Assessment Information Set (OASIS) and Medicare claims data for 1,217 Medicare beneficiaries receiving family caregiver assistance during a home health episode between 2011-2016. Models are weighted for propensity score adjustment and to account for NHATS survey design.

† Holding all covariates at their means. Covariates include: older adults' sociodemographic characteristics (age, sex, race, Medicaid enrollment), receipt of caregiver assistance (number of caregivers, help with medications, level of functional assistance), and health and functional status (fallen in prior year, self-rated overall health). prior to home health, older adults' health and functional status (clinical severity, post-acute status, functional impairment, cognitive impairment, receipt of any respiratory or IV therapies, presence of ulcer or wound), and home health provider nonprofit status.

CHAPTER FIVE: FAMILY CAREGIVERS' UNMET NEED FOR TRAINING AND ACUTE CARE UTILIZATION AMONG MEDICARE BENEFICIARIES RECEIVING HOME HEALTH

5.1 Abstract

Background: More than one in three family caregivers to Medicare home health patients have an identified need for training. The Centers for Medicare and Medicaid Services (CMS) recently revised the Medicare Home Health Conditions of Participation to require that providers train family caregivers, as needed to support the plan of care. How training of family caregivers affects patient outcomes in the home health setting is unknown.

Objectives: To estimate the proportion of family caregivers assisting Medicare home health patients who have an unmet need for training and quantify associations between family caregivers' unmet need for training and older adults' acute care utilization during home health.

Methods: Nationally representative, retrospective cohort study using linked National Health and Aging Trends Study (NHATS), Outcomes and Assessment Information Set (OASIS), Medicare claims, and Medicare Provider of Services (POS) data for 1,217 (weighted n=5,870,905) community-dwelling older adults receiving Medicare-funded home health care between 2011-2016. Family caregivers' unmet need for training refers to an identified need for training (measured from OASIS) without receipt of training visits (measured from claims) during a home health episode. Unmet need for training was measured for each of the following caregiving activities: household chores, self-care

tasks, medication management, patient supervision, or any activity. Weighted, multivariable logistic regressions were used to examine the odds of acute care utilization among older adults receiving Medicare home health care as a function of family caregivers' unmet need for training. Models adjusted for older adult sociodemographic characteristics, health, and functional status, home health care intensity, and provider characteristics.

Results: Rates of unmet need for training varied by activity, from 8.2% of family caregivers assisting with household chores to 16.1% of those assisting with self-care tasks. After controlling for older adult and home health provider characteristics, older adults whose family caregiver had an unmet need for training with any caregiving activity were twice as likely to incur acute care utilization (Adjust Odds Ratio (aOR): 2.01, p=0.009). Older adults whose family caregivers had an unmet need for training with individual caregiving activities (household chores, self-care tasks, medication management, or patient supervision) also experienced between a two- to three-fold increased likelihood of acute care utilization (aOR: 1.98, p=0.02; aOR: 3.11, p=0.001; aOR: 2.50, p=0.001; aOR: 2.92, p=0.007, respectively).

Conclusions: Family caregivers' unmet need for training is associated with greater likelihood of acute care utilization among older adults receiving home health. Findings indicate that training family caregivers may positively affect service delivery outcomes and support the importance of expanding supports for family caregivers.

5.2 Introduction

Millions of older adults rely on family and unpaid caregivers to help with daily activities ranging from household chores to medical and nursing tasks.[3,10] A growing body of evidence suggests that the availability, capacity, and characteristics of family caregivers affect older adults' health care utilization and outcomes[7,8,11,12,95] and that providing training for family caregivers may improve such outcomes in ambulatory care settings.[10,26,27,31,80] However, just 1 in 10 family caregivers report receiving training related to their caregiving activities.[16]

Family caregivers play an important role during Medicare home health care, a benefit through which eligible beneficiaries receive skilled nursing, rehabilitation therapy, and personal care services delivered in their homes. Medicare beneficiaries who access home health have significant social and clinical complexity.[21] As home health staff are only intermittently present in the home, executing the plan of care is often contingent on help provided by family caregivers.[96] Home health clinicians report that family caregiver assistance is needed, in addition to care provided by home health staff, in 87% of index Medicare home health episodes.[62]

More than one in three family caregivers assisting during Medicare home health have an identified need for training related to caregiving activities.[87] Rates of need for training vary by caregiving activity and are greatest among those assisting with medical or nursing activities, such as medication management.[87] Although family caregivers' identified need for training has been shown to affect care intensity during Medicare

home health, no significant association was found between identified need for training and provision of training by home health clinicians.[97] This raises questions about home health providers' ability to comply with recent changes to the Medicare Home Health Conditions of Participation, which now require home health providers to offer family caregiver training,[24] as well as the potential consequences of failing to meet family caregivers' training needs in this setting.

This is the first study to examine the relationship between family caregivers' unmet needs for training and patient outcomes in the home health setting. Drawing on a nationally representative sample of Medicare beneficiaries experiencing home health between 2011-2016, we model the relationship between caregivers' unmet need for activity-specific training and older adults' acute care utilization during the home health episode. Findings are relevant to ongoing efforts to reduce unplanned hospital readmissions, improve home health care quality, and connect family caregivers with training supports in care delivery settings.

5.3 Methods

Data Sources and Analytic Sample

Data for this study were drawn from four linked data sources: the National Health and Aging Trends Study (NHATS), the Outcomes and Assessment Information Set (OASIS), Medicare claims, and Medicare Provider of Services (POS) files. NHATS is an annual, nationally representative survey of Medicare beneficiaries ages 65 and older that collects comprehensive information on participants' sociodemographic characteristics, health and functional status, and assistance from family and unpaid caregivers via in-

person interviews. OASIS is a standardized patient assessment completed by home health staff (either a Registered Nurse (RN) or Physical Therapist (PT)) and submitted to CMS at regular intervals during a Medicare-funded home health episode. OASIS includes information regarding the older adult's clinical and functional status, plan of care, and receipt of assistance from family caregivers. (OASIS items specify "non-agency caregiver"; however, we use the term "family caregiver" throughout this paper given that the majority of our sample reports having no paid caregiver assistance and prior work demonstrates the unique contributions of family caregivers to home health care.[22,98,99]) POS files are publicly-available sources of information on the characteristics of Medicare-certified providers, including home health providers.

The analytic sample includes 1,217 older adults who participated in the 2011 NHATS and received Medicare-funded home health within one year of the baseline interview (2011) or a subsequent interview (2012-2015). We pooled NHATS data from 2011-2015 with linked OASIS data and Medicare claims from 2011-2016. For each participant, we matched the OASIS Start of Care filing for the first (index) home health episode during the observation period with the NHATS interview immediately preceding the index home health episode. We then included claims filed for services provided during the 60-day index home health episode. Finally, we used CMS Certification Numbers (unique identifiers assigned to each Medicare-certified provider) present in the claims to link to POS data for each provider from the year in which the index episode occurred.

We exclusively examined the index home health episode; therefore, each participant appears in the dataset once. We excluded NHATS participants who did not receive home health care during the observation period as well as those living in congregate settings such as assisted living facilities at the time of the NHATS interview due to the availability of supports that may substitute for or otherwise affect family caregiving. Additionally, our sample excludes Medicare Advantage enrollees, given that claims data were not available for this population.

Measures

Older Adult and Home Health Provider Characteristics

From NHATS, we drew measures of older adults' sociodemographic characteristics (age, sex, race, Medicaid-enrollment), health status (self-reported health status and prior year hospitalization), and receipt of family caregiver assistance (help with household chores, mobility tasks, or self-care tasks) prior to home health. From OASIS, we drew measures of older adults' living arrangement (whether they lived alone), post-acute status (whether they received inpatient care within 14 days of home health care), care intensity (whether they received any respiratory therapy or any IV treatment), clinical severity, functional impairment, and cognitive impairment during home health. Clinical severity and functional impairment during the home health episode are determined from Health Insurance Prospective Payment System (HIPPS) codes.[51] These codes are used for home health payment risk adjustment[51] and identify home health patients as having little or no, moderate, or significant functional impairment and low, moderate, or significant clinical severity. Cognitive impairment was measured via

home health clinician assessment of the older adult.[41] Older adults were considered to have no cognitive impairment if the home health clinician noted that they were "alert and oriented…comprehend and recall task direction independently" and some cognitive impairment otherwise.[41]

From POS, we drew measures of home health provides' nonprofit status, defined as a nongovernmental agency which is exempt from Federal Income taxation pursuant to section 501 of the Internal Revenue Code of 1954,[52] number of full-time equivalent employees, and hospital affiliation (whether the provider is a hospital-based program). From Medicare claims we measured care intensity based on the number and type of home health visits provided within the 60-day index home health episode. We created count variables for number of nursing and therapy visits incurred in this timeframe, identifying the type of visit using Healthcare Common Procedure Coding System (HCPCS) codes.[47,50] Nursing visits include visits from a Registered Nurse (RN) or Licensed Practical Nurse (LPN) to provide direct care, evaluate the plan of care, or observe/assess patient's condition. Therapy visits include visits from a Physical Therapist (PT), Occupational Therapist (OT), Speech Language Therapist, or PT or OT Assistant to provide direct care or develop a program of therapy. Given that nearly one-fourth (22.4%) of the sample received no therapy visits, we chose to create a binary indicator of receipt of any therapy visits for use in our analyses.

Family Caregivers' Unmet Need for Training

In OASIS, home health clinicians document whether an older adult needs family caregiver assistance with specific activities, whether they receive this assistance, and whether the caregiver needs training/supervision in order to provide this assistance.[41] We considered four caregiving activities specified in the OASIS: activities for which at least 50% of older adults were assessed as requiring family caregiver assistance[62] and at least 10% of caregivers had an identified need for training.[87] These four activities are household chores, self-care tasks, medication management, and patient supervision. For all analyses, we limit our analytic sample to episodes in which the older adult is identified as receiving family caregiver assistance with the given caregiving activity.

We measured family caregivers' unmet need for training for each caregiving activity using information from both the OASIS and Medicare claims. From the OASIS, we determined whether the family caregiver had an identified need for training with the given activity based on home health clinician reports. From claims data, we determined whether any training had been provided during the older adult's 60-day index home health episode. Claims include a count of the number of training visits, defined as visits made by a Registered Nurse (RN) or Licensed Practical Nurse (LPN) to offer training/education.[47] As the majority of the sample (weighted proportion=67.82%) experienced zero training visits, we created a binary variable equal to "1" if any training visits were received and "0" otherwise.

We then created a binary indicator of unmet need for training, defined as having an identified need for training without receiving any training visits. There is no unmet need for training if 1) the family caregiver had no identified need for training or 2) if the family caregiver had an identified need for training but received one or more training visits. We measured unmet need for training for each caregiving activity (household chores, self-care tasks, medication management, and patient supervision) and created a composite measure for unmet need for training with ***any*** of these four activities.

Acute Care Utilization

A binary indicator of acute care utilization was constructed for each home health patient from OASIS filings. We identified whether each patient had any OASIS filings indicating Emergency Department (ED) use or inpatient hospitalization during their home health episode, including resumption of stay following an acute care hospital stay or transfer to an inpatient facility, discharge to an acute care hospital, and ED use since the previous OASIS assessment.

Statistical Analysis

We used weighted, multivariable logistic regressions to model the odds of acute care utilization among older adults receiving Medicare home health care, as function of unmet need for family caregiver training with specific caregiving activities. All models adjusted for a range of covariates including older adults' sociodemographic characteristics, health status and family caregiver assistance before and during home health, and home health care intensity and provider characteristics. All models were

weighted to provide nationally representative estimates and account for complex survey design. All analyses were performed using Stata 14 (StataCorp LLC, College Station, TX).

5.4 Results

The sample for this study included 1,217 (weighted n=5,870,905) community-dwelling Medicare beneficiaries receiving home health between 2011-2016 (Table 5.1). The average age of this sample was 79.8 years, 19.6% of the sample were non-white, 16.7% were Medicaid-enrolled, and 71.0% were admitted to home health following an acute care episode. Among family caregivers assisting these Medicare beneficiaries during home health, unmet need for training varied by caregiving activity from a low of 8.2% among those assisting with household chores to about 16% of those assisting with medication management and self-care tasks (Figure 5.1).

Among community-dwelling Medicare beneficiaries receiving home health, 15.2% incurred acute care utilization during their index home health episode (Table 5.1). Older adults receiving family caregiver assistance were more likely to incur acute care utilization if the family caregiver had one or more unmet needs for training (Figure 5.2). After controlling for a range of older adult and home health provider characteristics, older adults whose family caregiver had unmet need(s) for training on any activity were twice as likely to incur acute care utilization (Adjust Odds Ratio (aOR): 2.01, p=0.009). Older adults whose family caregivers had unmet needs for training with specific activities experienced two- to three-fold greater likelihood of acute care utilization; ranging from unmet need for training with household chores (aOR: 1.98, p=0.02) to

unmet need for training with self-care tasks (aOR: 3.11, p=0.001). (For full regression results, see Appendix 3, Tables A18-A23.)

5.5 Discussion

This study finds that older adults whose family caregivers have unmet need for training with any caregiving activity are twice as likely to incur acute care utilization during Medicare home health. This relationship persists when considering unmet need for training with specific caregiving activities, ranging from a two- to three-fold increase in likelihood of acute care utilization, depending on the activity. Older adults who relied on family caregivers with unmet need for training with self-care tasks or patient supervision had the greatest likelihood of acute care utilization. Our findings indicate that training family caregivers may affect service delivery outcomes and support the importance of expanding family caregivers' access to training and other sources of support.

In the majority of episodes during which family caregivers were providing assistance, we observed no unmet need for family caregiver training, either because the caregiver had no identified need for training or because training visits were provided. This bodes well for home health providers' ability to comply with recent changes to the Medicare Home Health Conditions of Participation (COP) that require the provision of family caregiver training as needed to support the plan of care.[24] However, in cases where training needs are unmet, findings indicate that there may be negative consequences for patient clinical outcomes. Both providers and payers have identified reducing unplanned acute care utilization as an important goal to help reduce costs and improve quality of care,[26,100,101] particularly in post-acute care settings. Home health care currently has the

highest rate of hospitalization among Medicare post-acute care settings (compared to Skilled Nursing Facilities or Inpatient Rehabilitation Facilities).[19] Findings from our study suggest that expanding family caregivers' access to training during home health could reduce hospitalization risk, and potentially improve care quality in this setting.

The existing literature surrounding family caregiver training evaluates training interventions, rather than the impacts of unmet need for training, and largely measures the success of these programs by their effect on caregiver-reported outcomes (e.g. depressive symptoms, burden, sense of self-efficacy related to caregiving).[25,27-29,31] Study results indicate the importance of appropriately targeting and prioritizing training interventions, to ensure that resources are matched with caregivers who are most in need of training and support, and reveal one potential avenue (reductions in hospitalization) by which investment in family caregiver training may be cost-effective for integrated health systems and/or payers.

Family caregivers have traditionally, and incorrectly, been considered "informal" providers of care and, as a result, rarely integrated into the care team or offered adequate training/support.[10,14,15,68] Yet a growing body of evidence demonstrates that family caregivers are instrumental in meeting the needs of older adults with chronic illness or disability, assume wide-ranging responsibilities including assistance with complex health-related activities, and help to shape health care spending and clinical outcomes for this population.[3,7,8,10,95] This study illustrates the importance of interactions

between family caregivers and health care providers in determining clinical outcomes for older adults.

Family caregivers, like other care team members, need appropriate training in order to deliver high-quality care. Ongoing research aimed at developing and evaluating family caregiver training interventions is promising; yet there are few programs designed for care delivery settings.[29,31] Additionally, providers face a range of obstacles to delivering family caregiver training, including a small number of reimbursement options[15,73] and limited professional preparation related to interacting with family caregivers.[14] Expanded reimbursement for provider/caregiver interactions and funding for pilot programs to develop family caregiver training programs for care delivery settings are needed in order to capitalize on this important opportunity to improve care quality and outcomes for high-need older adults.

Limitations

Several limitations merit comment. Due to our reliance on claims data to ascertain receipt of training, our sample is limited to Medicare Fee-for-Service and findings may not be applicable to older adults enrolled in Medicare Advantage. We rely on the OASIS for measures of caregiver need for activity-specific training. OASIS is the only available national source of data on family caregiver factors during home health; however, research on the reliability and validity of OASIS items is generally sparse[81] and no available research tests the psychometric properties of these measures in particular. We limit our sample to index home health episodes and therefore our findings may not

be reflective of later episodes in a sustained period of home health utilization. Finally, our sample size is constrained to older adults who participated in a national survey; future studies should extend analyses to larger samples of individuals receiving home health care.

5.6 Conclusion

We find that family caregivers' unmet need for training is associated with greater likelihood of acute care utilization among older adults receiving family caregiver assistance during Medicare home health. Findings support recent policy efforts to expand family caregiver access to training in care delivery settings and indicate the potential of appropriate training of family caregivers to mitigate hospitalization risk among older adults receiving home health care.

Tables

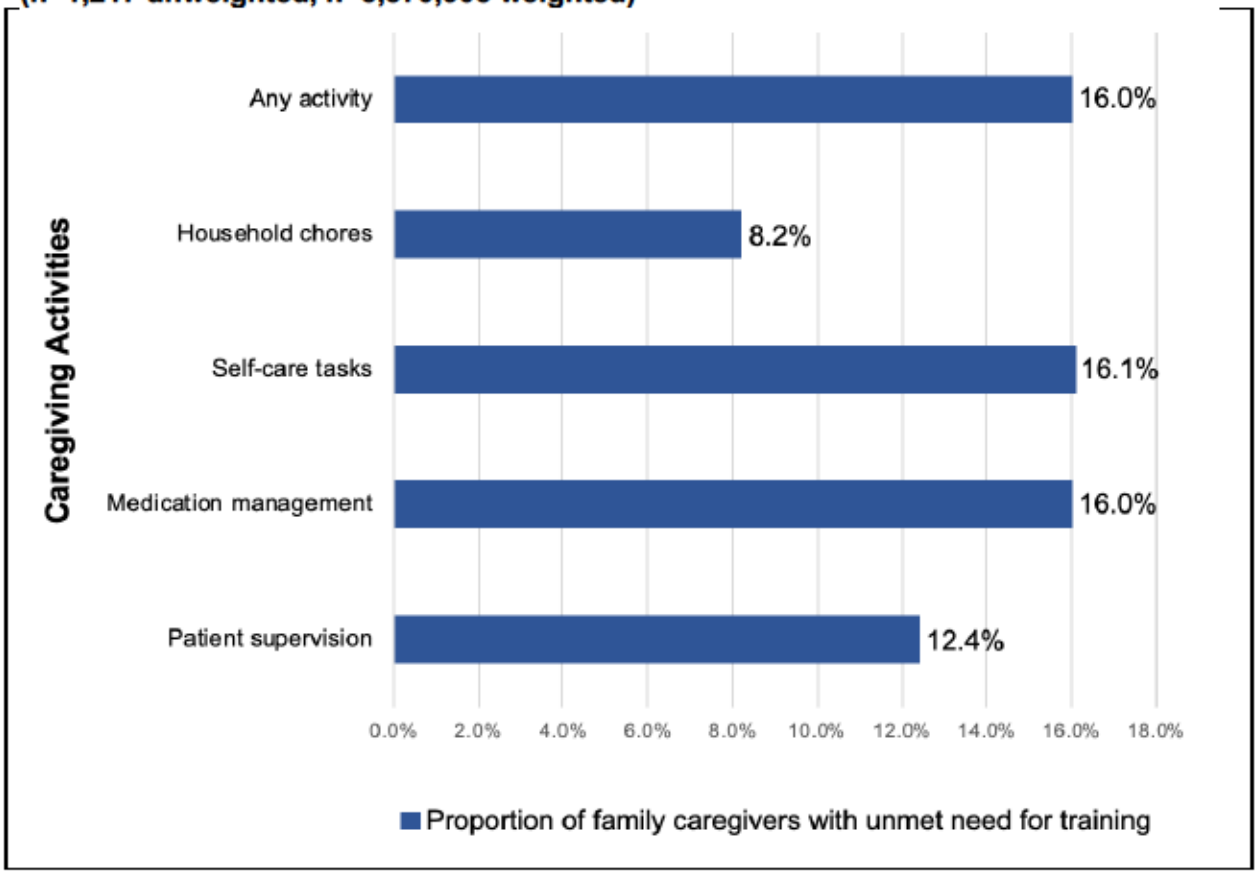
Table 5.1. Characteristics of Community-Dwelling Older Adults Receiving Family Caregiver Assistance during Medicare Home Health between 2011-2016 (n=1,217 unweighted, n=5,870,905 weighted)*

Characteristic	% (*n*) or Mean ± *SE*
Older Adult Characteristics	
Age	79.8 ± 0.29
Male sex	40.5% *(468)*
Non-white race	19.6% *(401)*
Medicaid-enrolled	16.7% *(250)*
Prior to Home Health	
Self-rated health:	
Excellent/very good	26.4% *(285)*
Good	31.7% *(381)*
Fair/poor	41.9% *(551)*
Hospitalized in past year	
Receives functional assistance with:	
None	40.1% *(421)*
Household chores	27.1% *(318)*
Mobility	7.4% *(109)*
Self-care	25.4% *(369)*
During Home Health	
Incurs acute care utilization	15.2% *(195)*
Lives alone	32.8% *(400)*
Post-acute	71.0% *(794)*
Clinical severity	
Low	26.5% *(331)*
Moderate	41.1% *(485)*
High	32.4% *(401)*
Functional impairment	
None/low	17.2% *(190)*
Moderate	62.4% *(762)*
High	20.4% *(265)*
Cognitive impairment	44.1% *(605)*
Care Intensity During Home Health	
Receipt of any respiratory therapy	10.5% *(137)*
Receipt of any IV treatment	2.1% *(24)*
Number of nursing visits received	7.2 ± 0.26
Receipt of any therapy visits	77.6% (945)
Home Health Provider Characteristics	
Nonprofit	46.2% *(455)*
Number of full-time equivalent employees	98.4 ± 20.1
Affiliated with an acute care hospital	15.7% *(151)*

* Data are drawn from National Health and Aging Trends Study (NHATS) and linked Outcomes and Assessment Information Set (OASIS), Medicare claims data, and Provider of Services data for 1,217 Medicare beneficiaries receiving family caregiver assistance during a home health episode between 2011-2016. Percentages are weighted to account for NHATS survey design and to produce nationally representative estimates.

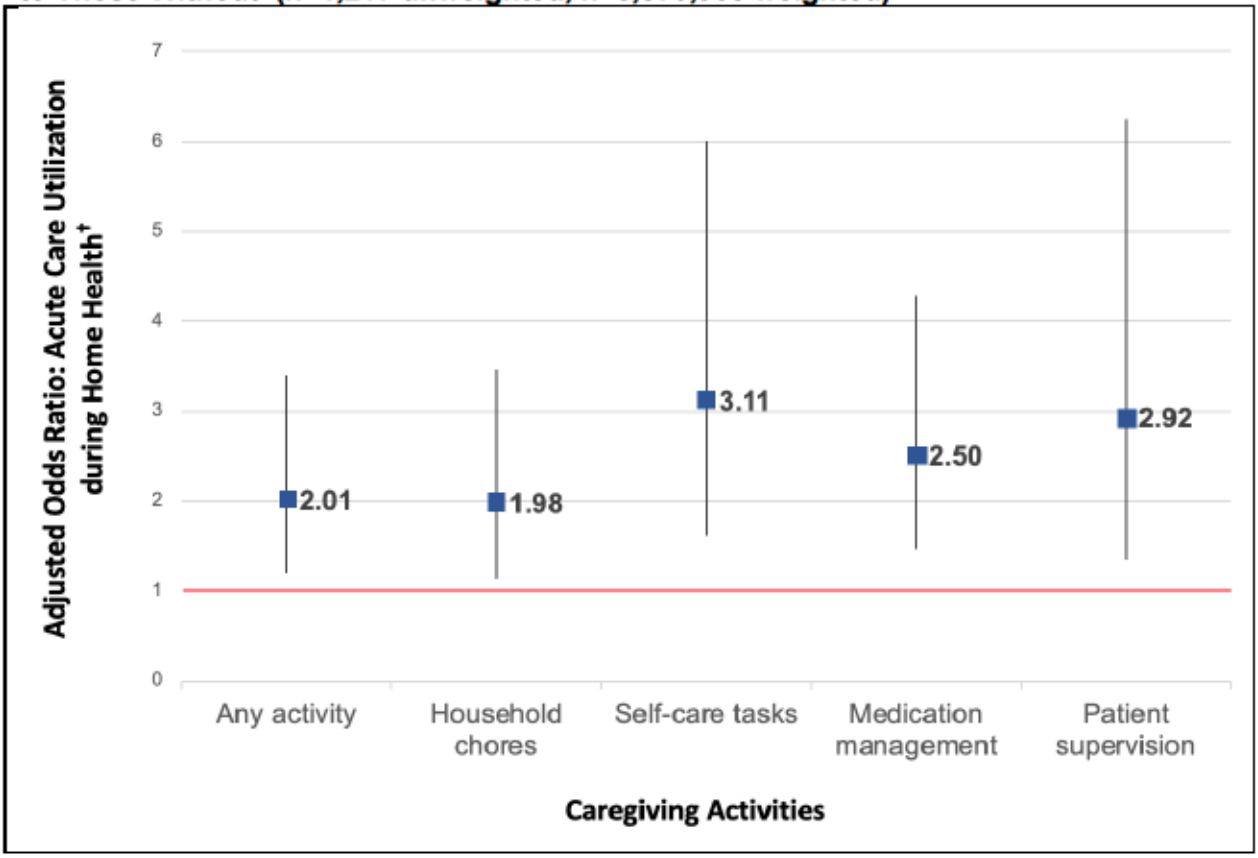
Figures

Figure 5.1. Rates of Unmet Need for Training among Family Caregivers to Medicare Beneficiaries Receiving Home Health Care, by Activity (n=1,217 unweighted, n=5,870,905 weighted)*



* Data are drawn from National Health and Aging Trends Study (NHATS) and linked Outcomes and Assessment Information Set (OASIS), Medicare claims data, and Provider of Services data for 1,217 Medicare beneficiaries receiving family caregiver assistance during a home health episode between 2011-2016. Proportions are weighted to account for complex survey design.

Figure 5.2. Odds of Acute Care Utilization among Medicare Beneficiaries Receiving Home Health Care, Comparing those with Unmet Need for Family Caregiver Training to Those Without (n=1,217 unweighted, n=5,870,905 weighted)*



* Data are drawn from National Health and Aging Trends Study (NHATS) and linked Outcomes and Assessment Information Set (OASIS), Medicare claims data, and Provider of Services data for 1,217 Medicare beneficiaries receiving family caregiver assistance during a home health episode between 2011-2016. Proportions are weighted to account for complex survey design.

† Adjusted for: measures of older adults' sociodemographic characteristics (age, sex, race, Medicaid-enrollment), health status (self-reported health status and prior year hospitalization), and receipt of family caregiver assistance (help with household chores, mobility tasks, or self-care tasks) prior to home health; older adults' living arrangement (whether they lived alone), post-acute status (whether they received inpatient care within 14 days of home health care), care intensity (receipt of any respiratory therapy or any IV treatment, number of nursing visits received, receipt of any therapy visits), clinical severity, functional impairment, and cognitive impairment during home health; and home health provider non-profit status, number of full-time equivalent employees, and affiliation with any acute care hospital.

CHAPTER SIX: DISCUSSION AND IMPLICATIONS

Despite their important contributions to the care of older adults, family caregivers rarely receive the support and training they need.[10,14-16] This dissertation sought to better understand how family caregivers' training needs might impact care processes and outcomes experienced by older adults. To explore these research questions, we focused on a care setting in which providers rely heavily on family caregiver assistance: Medicare home health.[24,62] We drew on a nationally representative sample of community-dwelling Medicare beneficiaries who received family caregiver assistance during a Medicare home health episode between 2011-2016. Our findings suggest that a sizable segment of family caregivers assisting during home health require training, and that family caregivers' training needs affect care process and acute care utilization during home health. Results strengthen ongoing calls for expansion of provider-led support of family caregivers.

6.1 Key Findings

In Chapter 3, we estimated the proportion of family caregivers assisting during Medicare home health who had an identified need for training and identified older adult and family and caregiving network factors associated with family caregivers' identified need for training, across various caregiving activities. We found that more than 1 in 3 (35.7%) family caregivers assisting during Medicare home health had an identified need for training with at least one caregiving activity. Rates of need for training varied widely from 8.6% among caregivers helping with advocacy to 48.2% among caregivers helping with medical procedures. Caregivers were more likely to require training, across all

caregiving activities, if they were assisting an older adult with fewer care needs prior to the home health episode.

In Chapter 4, we determined that family caregivers' identified need for activity-specific training affects the number and type of visits received during an index home health episode. Older adults whose family caregiver had an identified need for training on household chores, self-care tasks, or medication management experienced a greater number of aide, therapy, and nursing visits, respectively.

In Chapter 5, we estimated the proportion of family caregivers assisting during Medicare home health who had an unmet need for training, and examined whether family caregivers' unmet need for training was associated with older adults' likelihood of acute care utilization during home health. Rates of family caregivers' unmet need for training varied by caregiving activity from 8.2% of those assisting with household chores to 16.1% of those assisting with self-care tasks. Older adults whose family caregiver had an unmet need for training with any caregiving activity were twice as likely to incur acute care utilization during home health.

6.2 Strengths and Limitations

Strengths

This research has multiple notable strengths. We explore novel and timely research questions with relevance to ongoing policymaking surrounding home health payment and regulation, as well as broader efforts to expand provider-led supports for family

caregivers. This is the first study to examine identified need for training among family caregivers, and its potential impact on care processes and outcomes, in a care delivery setting. Additionally, although there is tremendous variation in the types of assistance that caregivers provide,[1,3] this is the first research on family caregiving during home health to consider distinct caregiving activities and how these may differentially impact outcomes of interest.

We draw on a unique, longitudinal dataset from which we are able to establish a clear temporal sequence of older adult and caregiving network characteristics both before and during home health, creating the opportunity to control for contextual factors prior to the home health episode. Controlling for these contextual factors and likely confounders makes our analyses more robust to the threat of endogeneity and improves internal validity. Additionally, by focusing on NHATS participants and incorporating NHATS survey weights in our analyses, we ensure that our analytic sample and effect estimates are nationally representative. This lends strong external validity to our findings, which can inform providers and policymakers on a national scale. Finally, we employ propensity score adjustment (Chapter 4) and control for a wide range of meaningful covariates measured before and during the home health episode (Chapters 3, 4, and 5) in order to minimize the endogeneity threat present in all observational research.

Limitations

This research is subject to several limitations, largely relating to data availability and sample size. First, we rely on the OASIS for measures of family caregivers' identified

need for training. OASIS is the only available national source of data on caregiving during home health; yet, there is a paucity of evidence regarding the reliability and validity of OASIS measures[81] and no available research tests the psychometric properties of measures related to caregivers' identified need for training. Additionally, as our study cohort includes only Medicare beneficiaries who participated in the NHATS, our sample size is constrained. This may affect tests of statistical significance and further research is warranted which draws on additional years of NHATS/OASIS data. Due to our reliance on claims data to ascertain number/type of visits and receipt of training during home health, analyses in chapters 4 and 5 are limited to Medicare Fee-for-Service enrollees only and findings may not be applicable to Medicare Advantage enrollees. Finally, we limit our analytic sample to index home health episodes and therefore our findings may not be reflective of later episodes in a sustained period of home health utilization.

6.3 Implications

Implications for Research

We found that a significant proportion (35.7%) of family caregivers assisting during Medicare-funded home health have an identified need for training; yet no significant relationship was observed between identified need for training and receipt of training. While publicly-available caregiver training interventions exist, implementation studies have been limited to the ambulatory setting.[25,27,30,31] Given the apparent challenges faced by home health clinicians in providing caregiver training, there is a need for new knowledge to guide providers seeking to implement caregiver training interventions

during Medicare-funded home health. Future research could explore how frontline home health clinicians and staff determine family caregiver capacity and need for training, what obstacles exist to providing training in this setting, and how these training supports are currently structured.

Existing evaluations of family caregiver training interventions measure the success of these programs through caregiver-reported outcomes (e.g. depressive symptoms, burden, sense of self-efficacy related to caregiving)[25,27-29,31] or older adult quality of life and function.[25,80] Our results indicate that family caregivers' identified need for training, and whether that need is met, affects care processes and outcomes in the home health setting. Therefore, future evaluations of training programs should strive to incorporate measures of health care utilization and clinical outcomes. Additionally, ongoing research efforts which seek to measure risk-adjusted provider performance should consider including information on family caregiver availability, characteristics, and capacity, especially when assessing providers delivering services in the community setting.

Implications for Policy and Practice

Results of this study indicate the importance of access to training among family caregivers, and support recent revisions to Medicare Home Health Conditions of Participation which require providers to offer family caregiver training.[24] Additionally, findings lend urgency to ongoing policy efforts aimed at encouraging provider-led support of family caregivers.[36,37,73] Policies which improve access to training during transitions of care may be especially impactful, given that family caregivers are more

likely to have an identified need for training following an escalation in the older adult's care needs and given the potential of unmet need for training to contribute to hospitalization.

Although a variety of recent policy initiatives are underway,[24,36,37,73] there are multiple existing barriers to provider-led support of family caregivers. Structural factors including narrow reimbursement opportunities for time spent interacting with caregivers,[15,73] limited professional preparation related to caregiver training,[14] and a lack of scalable caregiver assessment tools/training programs specific to a given care delivery setting[10] make it difficult for clinicians to incorporate family caregiver training into existing care practices. Greater investment, in the forms of new reimbursement opportunities or funding of pilot training interventions, could help expand family caregivers' access to training and, in doing so, improve efficiency and outcomes for older adults.

6.4 Conclusion

Among a nationally representative sample of Medicare beneficiaries receiving family caregiver assistance during home health, we find that a significant proportion of family caregivers have an identified need for activity-specific training, that family caregivers' identified need for training affects care intensity and resource utilization during home health, and that family caregivers' unmet need for training is associated with greater likelihood of acute care utilization during home health. Findings are strongly supportive of growing awareness that family caregivers are important members of the care team and that they require support and training in order to deliver high-quality care.

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APPENDICES

Appendix 1: "Chapter Three: Identified Training Needs among Family Caregivers Assisting During Medicare Home Health"

A1.1 Outcomes and Assessment Information Set (OASIS) Definitions of Caregiving Activities

We measured family caregivers' identified need for training from home health clinician assessment data reported in the OASIS. Across seven caregiving activities, home health clinicians document whether an older adult needs family caregiver assistance with the activity, whether they receive this assistance, and whether the caregiver needs training/supervision in order to provide this assistance.[41] For each activity, we constructed a binary indicator of whether the family caregiver had an identified need for training, limiting the sample to cases in which home health clinicians identified the older adult as both requiring and receiving family caregiver assistance with that activity. OASIS specifies the following seven caregiving activities:

1. Household chores: assistance with household tasks such as meals, housekeeping, laundry, telephone, shopping, finances,
2. Self-care tasks: assistance with self-care tasks such as transfer/ambulation, bathing, dressing, toileting, eating/feeding,
3. Medication management: assistance with managing oral, inhaled or injectable medications,
4. Medical procedures: assistance with treatments or procedures such as changing wound dressings or a home exercise program,
5. Equipment management: assistance with oxygen, intravenous/infusion equipment, enteral/parenteral nutrition, or ventilator therapy equipment,

6. Patient supervision: assistance with supervision or monitoring to ensure older adult's safety,
7. Advocacy: assistance with patient's participation in appropriate medical care (for example, transportation to or from appointments).

A1.2 Associations between Older Adult Characteristics Measured during Medicare Home Health and Family Caregiver Identified Need for Activity-Specific Training

Table A1. Characteristics of Older Adults Receiving Family Caregiver Assistance during Medicare Home Health, by Identified Need for Family Caregiver Training with Household Chores* (n=1,519 unweighted, n=7,126,800 weighted)

Older adult characteristic (measured during home health)	No Need for Training *n (%)*	Need for Training *n (%)*	p-value
Post-acute entry to home health	891 (70.6)	134 (81.1)	<0.01
Cognitive impairment	627 (41.3)	107 (56.4)	<0.01
Functional impairment			
Little or no	191 (16.2)	—†	<0.001
Moderate	884 (65.7)	112 (61.6)	
Significant	263 (18.1)	61 (33.1)	
Clinical severity			
Low	362 (26.8)	38 (20.6)	0.11
Moderate	564 (43.1)	75 (41.1)	
Significant	412 (30.2)	68 (38.3)	

* Data are drawn from National Health and Aging Trends Study (NHATS) and linked Outcomes and Assessment Information Set (OASIS) data for 1,519 Medicare beneficiaries receiving family caregiver assistance with household chores during a home health episode between 2011-2016. Percentages are weighted to account for NHATS survey design and to produce nationally representative estimates.

† Data not reportable for unweighted cell frequencies <11, pursuant to authors' Data Use Agreement with the Centers for Medicare and Medicare Services.

Table A2. Characteristics of Older Adults Receiving Family Caregiver Assistance during Medicare Home Health, By Identified Need for Family Caregiver Training with Self-Care Tasks*
(n=1,384 unweighted, n=6,480,207 weighted)

Older adult characteristic (measured during home health)		No Need for Training *n (%)*	Need for Training *n (%)*	p-value
Post-acute entry to home health		685 (70.6)	262 (78.7)	0.02
Cognitive impairment		478 (39.6)	206 (56.5)	<0.001
Functional impairment				
	Little or no	114 (13.6)	13 (4.2)	<0.001
	Moderate	717 (68.8)	229 (65.3)	
	Significant	201 (17.6)	110 (30.5)	
Clinical severity				
	Low	275 (27.3)	81 (21.0)	0.10
	Moderate	425 (41.3)	155 (47.2)	
	Significant	332 (31.4)	116 (31.9)	

* Data are drawn from National Health and Aging Trends Study (NHATS) and linked Outcomes and Assessment Information Set (OASIS) data for 1,384 Medicare beneficiaries receiving family caregiver assistance with household chores during a home health episode between 2011-2016. Percentages are weighted to account for NHATS survey design and to produce nationally representative estimates.

Table A3. Characteristics of Older Adults Receiving Family Caregiver Assistance during Medicare Home Health, By Identified Need for Family Caregiver Training with Medication Management*
(n=1,217 unweighted, n=5,578,439 weighted)

Older adult characteristic (measured during home health)		No Need for Training *n (%)*	Need for Training *n (%)*	p-value
Post-acute entry to home health		594 (71.5)	231 (73.6)	0.50
Cognitive impairment		483 (49.0)	207 (59.9)	<0.01
Functional impairment				
	Little or no	95 (12.7)	23 (6.8)	<0.01
	Moderate	602 (66.8)	208 (64.6)	
	Significant	189 (20.5)	100 (28.6)	
Clinical severity				
	Low	249 (26.8)	60 (18.7)	0.01
	Moderate	367 (41.9)	139 (42.3)	
	Significant	270 (31.4)	132 (39.0)	

* Data are drawn from National Health and Aging Trends Study (NHATS) and linked Outcomes and Assessment Information Set (OASIS) data for 1,217 Medicare beneficiaries receiving family caregiver assistance with household chores during a home health episode between 2011-2016. Percentages are weighted to account for NHATS survey design and to produce nationally representative estimates.

Table A4. Characteristics of Community-Dwelling Medicare Beneficiaries Receiving Family Caregiver Assistance during a Home Health Episode, By Identified Need for Family Caregiver Training with Patient Supervision* (n=1,061 unweighted, n=4,870,844 weighted)

Older adult characteristic (measured during home health)		No Need for Training *n (%)*	Need for Training *n (%)*	p-value
Post-acute entry to home health		558 (68.0)	137 (74.4)	0.12
Cognitive impairment		518 (53.3)	132 (66.4)	<0.01
Functional impairment				
	Little or no	91 (12.6)	—†	<0.01
	Moderate	578 (65.3)	115 (63.3)	
	Significant	199 (22.1)	70 (32.3)	
Clinical severity				
	Low	228 (25.9)	42 (22.6)	0.66
	Moderate	357 (40.2)	85 (43.5)	
	Significant	283 (33.9)	66 (33.9)	

* Data are drawn from National Health and Aging Trends Study (NHATS) and linked Outcomes and Assessment Information Set (OASIS) data for 1,061 Medicare beneficiaries receiving family caregiver assistance with household chores during a home health episode between 2011-2016. Percentages are weighted to account for NHATS survey design and to produce nationally representative estimates.

† Data not reportable for unweighted cell frequencies <11, pursuant to authors' Data Use Agreement with the Centers for Medicare and Medicare Services.

Appendix 2: "Chapter Four: Effects of Family Caregiver Training Needs on Medicare Home Health Care"

A2.1 Complete Regression Results

Table A5. Frequency/Percentage of Sample Receiving Zero Visits during Index Medicare Home Health Episode, by Visit Type (n=1,217 unweighted, n=5,870,905 weighted)*

Visit type:	Frequency Receiving Zero Visits	Percentage Receiving Zero Visits
Nursing	126	9.78
Therapy	272	22.42
Personal care aide	984	82.73
Training	813	67.82

* Data are drawn from National Health and Aging Trends Study (NHATS) and linked Outcomes and Assessment Information Set (OASIS) and Medicare claims data for 1,217 Medicare beneficiaries receiving family caregiver assistance during a home health episode between 2011-2016. Percentages are weighted to account for NHATS survey design and to produce nationally representative estimates.

Table A6. Effect of family caregiver's need for household chore training on odds of receiving visits during a Medicare home health episode, by visit type (n=1,519 unweighted, n=7,126,800 weighted)*

	Home Health Visit Type							
	Nursing Visits		Therapy Visits		Aide Visits		Training Visits	
	aOR† (95% CI)	p-value	aOR (95% CI)	p-value	aOR (95% CI)	p-value	aOR (95% CI)	p-value
Family caregiver needs training on household chores	3.38 (1.33, 8.59)	0.01	1.01 (0.53, 1.90)	0.98	3.54 (1.82, 6.92)	<0.001	1.18 (0.71, 1.96)	0.52
Older Adult Characteristics								
Age	0.96 (0.92, 1.00)	0.07	1.01 (0.98, 1.04)	0.56	1.05 (1.01, 1.10)	0.02	1.00 (0.96, 1.04)	0.95
Male sex	1.13 (0.48, 2.63)	0.78	0.50 (0.29, 0.88)	0.02	0.59 (0.34, 1.02)	0.06	0.82 (0.47, 1.43)	0.48
Non-white race	0.63 (0.32, 1.27)	0.19	0.53 (0.27, 1.02)	0.06	1.27 (0.64, 2.54)	0.49	0.41 (0.24, 0.71)	0.002
Medicaid-enrolled	1.42 (0.48, 4.21)	0.53	0.63 (0.32, 1.24)	0.18	0.56 (0.18, 1.71)	0.30	1.83 (0.96, 3.48)	0.07
Prior to Home Health								
Number of caregivers	0.96 (0.74, 1.24)	0.76	0.97 (0.77, 1.21)	0.78	0.84 (0.63, 1.11)	0.22	0.94 (0.76, 1.16)	0.58
Receives assistance with medication management	0.83 (0.27, 2.54)	0.74	1.37 (0.55, 3.37)	0.49	2.83 (1.07, 7.48)	0.04	1.75 (0.92, 3.29)	0.09
Receives functional assistance with:								
None	REF		REF		REF		REF	
Household chores	1.69 (0.55, 5.17)	0.35	1.27 (0.65, 2.48)	0.48	1.46 (0.77, 2.78)	0.24	0.75 (0.44, 1.28)	0.29
Mobility	1.47 (0.44, 4.92)	0.52	1.27 (0.45, 3.56)	0.65	2.45 (0.67, 8.96)	0.17	0.66 (0.19, 2.28)	0.50
Self-care	3.13 (1.27, 7.67)	0.01	0.81 (0.32, 2.07)	0.66	1.97 (0.75, 5.17)	0.16	0.89 (0.40, 1.30)	0.77
Lives alone	1.21 (0.57, 2.56)	0.35	1.35 (0.66, 2.76)	0.40	1.18 (0.54, 2.59)	0.67	1.46 (0.64, 3.35)	0.36
Fallen in past year	0.68 (0.34, 1.36)	0.27	1.13 (0.57, 2.22)	0.73	0.95 (0.53, 1.69)	0.86	0.85 (0.55, 1.30)	0.45
Self-rated health:								
Excellent/very good	REF		REF		REF		REF	
Good	0.87	0.79	0.75	0.53	0.29	0.003	1.23	0.51

	(0.32, 2.41)		(0.30, 1.86)		(0.13, 0.63)		(0.65, 2.33)	
Fair/poor	1.22 (0.51, 2.93)	0.66	1.08 (0.47, 2.47)	0.86	0.68 (0.36, 1.31)	0.25	2.12 (1.03, 4.38)	0.04
During Home Health								
Lives alone	1.08 (0.55, 2.11)	0.83	0.56 (0.24, 1.29)	0.17	0.65 (0.29, 1.47)	0.30	0.52 (0.23, 1.18)	0.11
Post-acute	1.61 (0.64, 4.07)	0.30	1.45 (0.62, 3.39)	0.39	1.05 (0.49, 2.22)	0.90	1.13 (0.68, 1.89)	0.63
Any respiratory therapy	2.23 (0.74, 6.75)	0.15	0.72 (0.31, 1.68)	0.44	2.35 (0.93, 5.96)	0.07	1.16 (0.56, 2.42)	0.69
Any IV therapy	Omitted due to lack of variation		0.05 (0.01, 0.31)	0.002	0.02 (<0.01, 0.34)	0.007	0.71 (0.15, 3.45)	0.67
Clinical severity								
Low	REF		REF		REF		REF	
Moderate	1.40 (0.68, 2.89)	0.36	0.83 (0.30, 2.28)	0.71	1.51 (0.73, 3.11)	0.26	1.53 (0.88, 2.64)	0.13
High	6.24 (2.55, 15.26)	<0.001	0.68 (0.26, 1.78)	0.43	2.13 (0.98, 4.66)	0.06	1.76 (1.05, 2.97)	0.03
Functional impairment								
None/low	REF		REF		REF		REF	
Moderate	0.65 (0.27, 1.55)	0.32	1.91 (0.84, 4.32)	0.12	1.97 (0.67, 5.76)	0.21	0.91 (0.49, 1.66)	0.74
High	0.31 (0.07, 1.27)	0.10	3.87 (1.33, 11.20)	0.01	1.82 (0.63, 5.26)	0.27	0.67 (0.25, 1.79)	0.42
Cognitive impairment	1.62 (0.62, 4.22)	0.31	0.84 (0.48, 1.47)	0.54	0.62 (0.34, 1.13)	0.11	0.76 (0.47, 1.24)	0.27
Pressure ulcer	Omitted due to lack of variation		0.67 (0.20, 2.22)	0.50	0.88 (0.19, 4.03)	0.87	0.40 (0.09, 1.79)	0.23
Wound	1.47 (0.38, 5.74)	0.57	1.24 (0.62, 2.51)	0.54	1.45 (0.80, 2.63)	0.22	0.99 (0.54, 1.83)	0.98
Home Health Provider Characteristics								
Nonprofit	0.40 (0.16, 0.96)	0.04	0.85 (0.55, 1.30)	0.45	1.57 (0.78, 3.18)	0.20	0.38 (0.19, 0.77)	0.008

* Data drawn from National Health and Aging Trends Study (NHATS) and linked Outcomes and Assessment Information Set (OASIS) data for 1,519 Medicare beneficiaries receiving family caregiver assistance with household chores during home health, 2011-2016.
† Adjusted Odds Ratio.

Table A7. Effect of family caregiver's need for self-care task training on odds of receiving visits during a Medicare home health episode, by visit type (n=1,384 unweighted, n=6,480,207 weighted)*

	Home Health Visit Type							
	Nursing Visits		Therapy Visits		Aide Visits		Training Visits	
	aOR† (95% CI)	p-value	aOR (95% CI)	p-value	aOR (95% CI)	p-value	aOR (95% CI)	p-value
Family caregiver needs training on self-care tasks	1.33 (0.73, 2.43)	0.35	1.70 (1.01, 2.86)	0.04	2.12 (1.11, 4.05)	0.02	1.49 (1.01, 2.21)	0.04
Older Adult Characteristics								
Age	0.99 (0.95, 1.03)	0.59	1.01 (0.98, 1.04	0.44	1.04 (1.00, 1.08)	0.04	0.99 (0.96, 1.02)	0.41
Male sex	1.14 (0.57, 2.27)	0.71	0.50 (0.30, 0.83	0.009	0.71 (0.47, 1.07)	0.10	0.81 (0.52, 1.28)	0.36
Non-white race	0.56 (0.27, 1.13)	0.10	0.53 (0.31, 0.89)	0.02	1.07 (0.60, 1.90)	0.82	0.46 (0.29, 0.75)	0.002
Medicaid-enrolled	2.60 (1.10, 6.13)	0.03	0.69 (0.36, 1.32	0.26	0.93 (0.39, 2.21)	0.87	1.73 (0.92, 3.26)	0.09
Prior to Home Health								
Number of caregivers	0.86 (0.65, 1.15)	0.31	1.05 (0.88, 1.26)	0.55	0.87 (0.69, 1.09)	0.21	1.03 (0.87, 1.22)	0.72
Receives assistance with medication management	1.11 (0.46, 2.68)	0.82	1.15 (0.52, 2.50)	0.73	1.49 (0.67, 3.32)	0.33	1.44 (0.76, 2.72)	0.26
Receives functional assistance with:								
None	REF		REF					
Household chores	2.10 (0.87, 5.06)	0.10	1.10 (0.65, 1.86)	0.73	1.49 (0.83, 2.67)	0.18	0.88 (0.53, 1.46)	0.62
Mobility	0.94 (0.31, 2.89)	0.92	0.88 (0.35, 2.20)	0.78	2.10 (0.81, 5.47	0.12	0.55 (0.23, 1.36)	0.19
Self-care	1.25 (0.59, 2.61)	0.55	0.92 (0.44, 1.93)	0.82	2.39 (1.14, 5.00)	0.02	0.88 (0.42, 1.81)	0.72
Lives alone	0.98 (0.46, 2.08)	0.96	1.09 (0.60, 1.98)	0.77	1.12 (0.55, 2.26)	0.76	1.25 (0.73, 2.15)	0.42
Fallen in past year	0.77 (0.39, 1.51)	0.43	1.46 (0.86, 2.50)	0.16	1.21 (0.79, 1.84)	0.38	0.87 (0.58, 1.29)	0.48
Self-rated health:								
Excellent/very good	REF		REF		REF		REF	

Good	1.00 (0.45, 2.20)	0.99	1.00 (0.50, 2.03)	0.99	0.56 (0.29, 1.07)	0.08	1.09 (0.66, 1.80)	0.73
Fair/poor	0.79 (0.35, 1.77)	0.56	1.09 (0.61, 1.96)	0.77	0.75 (0.43, 1.31)	0.31	1.80 (1.09, 2.95)	0.02
During Home Health								
Lives alone	0.98 (0.63, 2.85)	0.44	0.77 (0.41, 1.43)	0.40	1.11 (0.59, 2.06	0.74	0.72 (0.41, 1.27)	0.25
Post-acute	1.64 (0.83, 3.24)	0.15	1.38 (0.70, 2.72)	0.34	1.55 (0.86, 2.80)	0.14	1.44 (0.87, 2.39)	0.16
Any respiratory therapy	1.57 (0.57, 4.33)	0.15	0.80 (0.39, 1.67)	0.55	1.66 (0.77, 3.59)	0.19	1.20 (0.65, 2.21)	0.55
Any IV therapy	Omitted due to lack of variation		0.21 (0.04, 0.97)	0.05	0.03 (<0.01, 0.28)	0.002	1.51 (0.33, 6.97)	0.59
Clinical severity								
Low	REF		REF					
Moderate	1.82 (0.93, 3.57)	0.08	0.75 (0.33, 1.71)	0.49	1.19 (0.64, 2.21)	0.59	1.36 (0.90, 2.05)	0.15
High	4.46 (2.01, 9.91)	<0.001	0.47 (0.23, 0.97)	0.04	1.93 (0.57, 5.67)	0.07	1.35 (0.86, 2.11)	0.19
Functional impairment								
None/low	REF		REF					
Moderate	0.52 (0.23,1.21)	0.13	2.30 (1.03, 5.14)	0.04	1.91 (0.64, 5.75)	0.24	1.07 (0.57, 1.98)	0.84
High	0.19 (0.06, 0.54)	0.003	4.65 (1.83, 11.86)	0.002	1.80 (0.57, 5.67)	0.31	0.95 (0.40, 2.28)	0.91
Cognitive impairment	3.21 (1.69, 6.09)	0.001	0.71 (0.46, 1.10)	0.12	0.88 (0.56, 1.38)	0.57	1.03 (0.72, 1.48)	0.87
Pressure ulcer	Omitted due to lack of variation		0.76 (0.26, 2.25)	0.62	1.24 (0.38, 4.04)	0.72	0.37 (0.12, 1.20)	0.10
Wound	1.48 (0.52, 4.22)	0.46	1.26 (0.68, 2.36)	0.45	1.42 (0.89, 2.35)	0.17	1.02 (0.57, 1.84)	0.94
Home Health Provider Characteristics								
Nonprofit	0.51 (0.26, 0.99)	0.05	0.74 (0.49, 1.10)	0.14	1.36 (0.77, 2.39)	0.29	0.43 (0.25, 0.72)	0.002

* Data drawn from National Health and Aging Trends Study (NHATS) and linked Outcomes and Assessment Information Set (OASIS) data for 1,384 Medicare beneficiaries receiving family caregiver assistance with self-care tasks during home health. 2011-2016.
† Adjusted Odds Ratio.

Table A8. Effect of family caregiver's need for medication management training on odds of receiving visits during a Medicare home health episode, by visit type (n=1,217 unweighted, n=5,578,439 weighted)*

	Home Health Visit Type							
	Nursing Visits		Therapy Visits		Aide Visits		Training Visits	
	aOR† (95% CI)	p-value	aOR (95% CI)	p-value	aOR (95% CI)	p-value	aOR (95% CI)	p-value
Family caregiver needs training on medication management	3.03 (1.06, 8.68)	0.04	0.98 (0.54, 1.78)	0.94	1.08 (0.59, 1.98)	0.81	1.42 (0.94, 2.17)	0.10
Older Adult Characteristics								
Age	1.00 (0.95, 1.06)	0.96	1.01 (0.97, 1.04)	0.68	1.04 (1.00, 1.09)	0.04	0.99 (0.97, 1.03)	0.95
Male sex	1.27 (0.49, 3.27)	0.62	0.44 (0.27, 0.72)	0.002	0.56 (0.33, 0.94)	0.03	0.84 (0.51, 1.36)	0.47
Non-white race	0.73 (0.28, 1.87)	0.50	0.62 (0.35, 1.09)	0.10	1.04 (0.59, 1.83)	0.90	0.45 (0.26, 0.77)	0.005
Medicaid-enrolled	2.25 (0.87, 5.80)	0.09	0.83 (0.44, 1.57)	0.57	1.07 (0.49, 2.35)	0.87	1.70 (0.81, 3.54)	0.16
Prior to Home Health								
Number of caregivers	0.95 (0.76, 1.20)	0.68	1.11 (0.92, 1.35)	0.27	0.86 (0.72, 1.04)	0.12	0.97 (0.78, 1.20)	0.74
Receives assistance with medication management	0.70 (0.22, 2.27)	0.55	1.07 (0.49, 2.34)	0.86	1.79 (0.79, 4.06)	0.16	1.31 (0.65, 2.62)	0.44
Receives functional assistance with:								
None	REF		REF		REF		REF	
Household chores	3.78 (1.27, 11.30)	0.02	1.01 (0.52, 1.93)	0.99	1.32 (0.69, 2.52)	0.40	0.82 (0.48, 1.42)	0.48
Mobility	0.84 (0.21, 3.39)	0.80	0.78 (0.29, 2.15)	0.63	1.10 (0.39, 3.14)	0.85	0.55 (0.22, 1.37)	0.20
Self-care	1.87 (0.62, 5.65)	0.26	0.84 (0.36, 1.97)	0.68	1.72 (0.74, 4.03)	0.21	0.78 (0.35, 1.71)	0.53
Lives alone	0.96 (0.42, 2.17)	0.92	1.25 (0.67, 2.33)	0.47	1.22 (0.63, 2.39)	0.55	1.50 (0.92, 2.46)	0.11
Fallen in past year	0.92 (0.40, 2.12)	0.84	1.67 (0.93, 3.02)	0.09	1.30 (0.86, 1.96)	0.21	0.80 (0.55, 1.16)	0.23
Self-rated health:								
Excellent/very good	REF		REF		REF		REF	

Good	0.84 (0.27, 2.58)	0.75	1.00 (0.45, 2.22)	0.99	0.66 (0.34, 1.28)	0.21	1.18 (0.69, 2.03)	0.54
Fair/poor	0.78 (0.35, 1.77)	0.55	1.07 (0.51, 2.28)	0.85	0.67 (0.34, 1.30)	0.23	1.88 (1.12, 3.13)	0.02
During Home Health								
Lives alone	0.96 (0.43, 2.11)	0.91	0.81 (0.43, 1.55)	0.52	1.17 (0.63, 2.18)	0.60	0.64 (0.37, 1.08)	0.09
Post-acute	1.76 (0.64, 4.85)	0.27	1.50 (0.80, 2.80)	0.20	1.30 (0.65, 2.59)	0.45	1.22 (0.76, 1.95)	0.41
Any respiratory therapy	1.26 (0.42, 3.81)	0.68	0.77 (0.40, 1.49)	0.44	1.74 (0.80, 3.74)	0.16	1.12 (0.55, 2.28)	0.75
Any IV therapy	Omitted due to lack of variation		0.22 (0.05, 0.99)	0.05	0.03 (<0.01, 0.21)	0.001	1.26 (0.27, 5.89)	0.77
Clinical severity								
Low	REF		REF		REF		REF	
Moderate	3.43 (1.46, 8.03)	0.005	0.65 (0.26, 1.64)	0.36	1.76 (0.79, 3.92)	0.16	1.67 (1.01, 2.74)	0.04
High	6.86 (2.84, 16.60)	<0.001	0.45 (0.21, 0.97)	0.04	2.85 (1.35, 6.00)	0.007	1.43 (0.92, 2.22)	0.11
Functional impairment								
None/low	REF		REF		REF		REF	
Moderate	0.74 (0.20, 2.79)	0.65	2.67 (1.25, 5.69)	0.01	3.06 (0.94, 10.02)	0.06	0.83 (0.40, 1.76)	0.63
High	0.23 (0.05, 1.11)	0.07	5.61 (2.36, 13.32)	<0.001	4.05 (1.26, 13.01)	0.02	0.93 (0.36, 2.40)	0.88
Cognitive impairment	1.78 (0.92, 3.47)	0.09	0.84 (0.47, 1.50)	0.55	1.03 (0.61, 1.75)	0.91	1.06 (0.75, 1.50)	0.73
Pressure ulcer	Omitted due to lack of variation		1.74 (0.52, 5.78)	0.36	0.95 (0.30, 3.05)	0.93	0.30 (0.08, 1.15)	0.08
Wound	3.04 (0.58, 16.09)	0.19	1.11 (0.56, 2.19)	0.75	1.60 (0.96, 2.67)	0.07	0.94 (0.51, 1.73)	0.84
Home Health Provider Characteristics								
Nonprofit	0.60 (0.26, 1.39)	0.22	0.57 (0.36, 0.89)	0.01	1.67 (1.00, 2.78)	0.05	0.47 (0.26, 0.82)	0.009

* Data drawn from National Health and Aging Trends Study (NHATS) and linked Outcomes and Assessment Information Set (OASIS) data for 1,217 Medicare beneficiaries receiving family caregiver assistance with medication management during home health 2011-2016.
†Adjusted Odds Ratio.

Table A9. Effect of family caregiver's need for patient supervision training on odds of receiving visits during a Medicare home health episode, by visit type (n=1,061 unweighted, n=4,870,844 weighted)*

	Home Health Visit Type							
	Nursing Visits		Therapy Visits		Aide Visits		Training Visits	
	aOR† (95% CI)	p-value	aOR (95% CI)	p-value	aOR (95% CI)	p-value	aOR (95% CI)	p-value
Family caregiver needs training on patient supervision	1.63 (0.59, 4.54)	0.34	1.52 (0.81, 2.82)	0.19	1.15 (0.56, 2.39)	0.69	1.23 (0.73, 2.05)	0.43
Older Adult Characteristics								
Age	0.98 (0.93, 1.03)	0.35	1.01 (0.97, 1.04)	0.73	1.04 (0.99, 1.09)	0.08	1.00 (0.96, 1.04)	0.95
Male sex	0.70 (0.28, 1.71)	0.42	0.71 (0.40, 1.24)	0.22	0.49 (0.29, 0.85)	0.01	0.69 (0.40, 1.19)	0.18
Non-white race	0.45 (0.19, 1.08)	0.07	0.40 (0.23, 0.72)	0.003	0.89 (0.39, 2.02)	0.77	0.30 (0.15, 0.62)	0.002
Medicaid-enrolled	1.63 (0.63, 4.20)	0.31	0.78 (0.37, 1.63)	0.50	1.37 (0.49, 3.80)	0.54	1.81 (0.70, 4.71)	0.22
Prior to Home Health								
Number of caregivers	0.99 (0.72, 1.36)	0.94	1.07 (0.84, 1.38)	0.57	0.78 (0.61, 0.99)	0.05	1.02 (0.77, 1.34)	0.89
Receives assistance with medication management	1.24 (0.51, 3.01)	0.64	1.05 (0.39, 2.89)	0.92	2.07 (0.79, 5.47)	0.14	1.04 (0.50, 2.18)	0.91
Receives functional assistance with:								
None	REF		REF		REF		REF	
Household chores	1.94 (0.45, 8.03)	0.36	1.66 (0.75, 3.68)	0.21	1.63 (0.78, 3.42)	0.19	0.98 (0.48, 1.97)	0.95
Mobility	1.13 (0.32, 3.93)	0.85	2.48 (0.99, 6.24)	0.05	1.35 (0.40, 4.57)	0.63	0.64 (0.23, 1.78)	0.39
Self-care	1.26 (0.47, 3.33)	0.54	1.45 (0.50, 4.18)	0.49	2.66 (0.82, 8.63)	0.10	0.94 (0.33, 2.70)	0.91
Lives alone	0.80 (0.28, 2.24)	0.66	2.39 (1.15, 4.97)	0.02	1.10 (0.49, 2.45)	0.82	1.05 (0.59, 1.88)	0.86
Fallen in past year	0.95 (0.42, 2.13)	0.89	1.89 (1.01, 3.41)	0.05	1.27 (0.77, 2.10)	0.34	0.71 (0.43, 1.17)	0.18
Self-rated health:								
Excellent/very good	REF		REF		REF		REF	

Good	0.41 (0.18, 1.45)	0.16	0.61 (0.23, 1.62)	0.32	0.40 (0.19, 0.84)	0.02	1.23 (0.67, 2.26)	0.49
Fair/poor	0.39 (0.13, 1.18)	0.09	0.76 (0.38, 1.54)	0.44	0.58 (0.30, 1.11)	0.10	2.40 (1.28, 4.49)	0.007
During Home Health								
Lives alone	1.77 (0.78, 3.99)	0.17	0.63 (0.30, 1.31)	0.21	1.23 (0.63, 2.23)	0.53	0.90 (0.50, 1.62)	0.72
Post-acute	1.31 (0.58, 2.98)	0.51	1.43 (0.63, 3.27)	0.39	1.32 (0.61, 2.87)	0.47	1.48 (0.79, 2.78)	0.21
Any respiratory therapy	1.22 (0.41, 3.61)	0.72	0.83 (0.33, 2.07)	0.69	1.94 (0.81, 4.68)	0.14	1.02 (0.46, 2.25)	0.96
Any IV therapy	Omitted due to lack of variation		0.13 (0.02, 0.70)	0.02	0.03 (0.004, 0.29)	0.003	1.33 (0.16, 11.44)	0.79
Clinical severity								
Low	REF		REF		REF		REF	
Moderate	2.24 (0.81, 6.17)	0.12	0.57 (0.25, 1.32)	0.19	1.52 (0.60, 3.82)	0.37	1.16 (0.66, 2.03)	0.61
High	7.09 (2.53, 19.87)	<0.001	0.52 (0.22, 1.26)	0.14	3.55 (1.56, 8.05)	0.003	1.46 (0.80, 2.67)	0.21
Functional impairment								
None/low	REF		REF		REF		REF	
Moderate	1.04 (0.28, 3.89)	0.96	2.26 (0.90, 5.70)	0.08	2.63 (0.90, 7.71)	0.08	0.95 (0.41, 2.21)	0.91
High	0.36 (0.08, 1.69)	0.19	3.48 (1.19, 10.20)	0.02	3.67 (1.16, 11.61)	0.03	0.91 (0.32, 2.59)	0.85
Cognitive impairment	1.61 (0.55, 4.78)	0.38	0.80 (0.43, 1.46)	0.46	0.83 (0.44, 1.59)	0.57	1.01 (0.59, 1.74)	0.97
Pressure ulcer	Omitted due to lack of variation		1.87 (0.59, 5.93)	0.28	0.86 (0.22, 3.37)	0.83	0.35 (0.09, 1.38)	0.13
Wound	0.74 (0.17, 3.16)	0.67	1.88 (0.73, 4.87)	0.19	1.19 (0.59, 2.40)	0.62	0.62 (0.31, 1.24)	0.17
Home Health Provider Characteristics								
Nonprofit	0.41 (0.18, 0.93)	0.03	0.68 (0.42, 1.09)	0.11	1.66 (0.94, 2.92)	0.08	0.45 (0.24, 0.82)	0.01

* Data drawn from National Health and Aging Trends Study (NHATS) and linked Outcomes and Assessment Information Set (OASIS) data for 1,061 Medicare beneficiaries receiving family caregiver assistance with patient supervision during home health, 2011-2016.
† Adjusted Odds Ratio.

Table A10. Effect of family caregiver's need for household chore training on incidence of visits during Medicare home health episode, by visit type (n=1,519 unweighted, n=7,126,800 weighted)*

	Total Visits		Nursing Visits		Therapy Visits		Aide Visits		Training Visits	
	IRR† (95% CI)	p-value	IRR (95% CI)	p-value	IRR (95% CI)	p-value	IRR (95% CI)	p-value	IRR (95% CI)	p-value
Family caregiver needs training on household chores	1.19 (1.02, 1.40)	0.03	1.16 (0.98, 1.38)	0.08	1.03 (0.89, 1.19)	0.71	0.92 (0.61, 1.39)	0.68	0.81 (0.58, 1.11)	0.19
Older Adult Characteristics										
Age	1.00 (0.99, 1.01)	0.48	1.00 (0.99, 1.02)	0.58	1.00 (0.99, 1.01)	0.68	1.01 (0.98, 1.03)	0.48	1.03 (1.00, 1.06)	0.03
Male sex	1.08 (0.91, 1.28)	0.38	1.24 (1.06, 1.45)	0.008	1.08 (0.90, 1.30)	0.38	1.23 (0.81, 1.87)	0.32	1.28 (0.90, 1.82)	0.16
Non-white race	0.83 (0.72, 0.96)	0.01	0.96 (0.77, 1.19)	0.71	0.79 (0.66, 0.95)	0.01	1.36 (0.85, 2.18)	0.20	1.44 (1.00, 2.08)	0.05
Medicaid-enrolled	0.99 (0.85, 1.17)	0.97	1.02 (0.81, 1.29)	0.85	1.04 (0.87, 1.24)	0.66	2.03 (0.90, 4.59)	0.09	0.63 (0.36, 1.10)	0.10
Prior to Home Health										
Number of caregivers	1.05 (0.99, 1.11)	0.99	1.04 (0.98, 1.10)	0.23	1.03 (0.98, 1.09)	0.24	1.15 (0.99, 1.33)	0.07	1.09 (0.94, 1.26)	0.24
Receives medication management help	1.15 (0.95, 1.40)	0.16	1.09 (0.90, 1.32)	0.36	1.04 (0.81, 1.33)	0.77	0.87 (0.60, 1.27)	0.47	0.93 (0.51, 1.70)	0.82
Functional assistance:										
None	REF		REF		REF		REF		REF	
Household chores	1.19 (0.98, 1.45)	0.08	1.22 (0.99, 1.48)	0.06	1.11 (0.85, 1.44)	0.44	1.41 (0.83, 2.41)	0.20	0.86 (0.59, 1.25)	0.41
Mobility	1.29 (1.03, 1.62)	0.03	1.47 (1.05, 2.07)	0.03	1.10 (0.87, 1.39)	0.40	0.98 (0.47, 2.05)	0.96	0.88 (0.38, 2.05)	0.77
Self-care	1.14 (0.92, 1.41)	0.24	1.10 (0.89, 1.35)	0.37	1.11 (0.84, 1.47)	0.44	1.92 (0.97, 3.80)	0.06	0.93 (0.59, 1.45)	0.73
Lives alone	1.21 (1.01, 1.44)	0.04	1.26 (1.03, 1.54)	0.02	1.16 (0.96, 1.40)	0.13	1.34 (0.90, 2.01)	0.15	1.16 (0.56, 2.39)	0.69
Fallen in past year	0.98 (0.86, 1.12)	0.79	0.97 (0.83, 1.14)	0.73	0.96 (0.80, 1.15)	0.66	0.90 (0.63, 1.29)	0.57	0.81 (0.63, 1.04)	0.10
Self-rated health:										
Excellent/very good	REF		REF		REF		REF		REF	

Good	0.93 (0.77, 1.12)	0.41	0.96 (0.78, 1.18)	0.67	1.00 (0.83, 1.19)	0.97	0.66 (0.38, 1.17)	0.15	0.61 (0.36, 1.03)	0.06
Fair/poor	1.00 (0.85, 1.19)	0.96	1.01 (0.82, 1.25)	0.90	0.99 (0.83, 1.18)	0.91	0.87 (0.54, 1.41)	0.57	0.92 (0.56, 1.52)	0.75
During Home Health										
Lives alone	0.83 (0.68, 1.02)	0.07	0.88 (0.71, 1.09)	0.22	0.74 (0.62, 0.89)	0.002	1.21 (0.73, 2.01)	0.45	0.78 (0.43, 1.42)	0.42
Post-acute	0.93 (0.78, 1.09)	0.36	0.83 (0.69, 1.00)	0.06	0.98 (0.82, 1.18)	0.86	0.99 (0.72, 1.37)	0.97	0.75 (0.54, 1.03)	0.07
Any respiratory therapy	1.04 (0.88, 1.23)	0.62	1.18 (0.94, 1.49)	0.15	0.88 (0.70, 1.09)	0.24	1.72 (1.05, 2.80)	0.03	1.04 (0.71, 1.52)	0.85
Any IV therapy	0.32 (0.14, 0.73)	0.007	0.64 (0.31, 1.32)	0.22	0.31 (0.10, 0.97)	0.04	3.77 (1.57, 9.07)	0.004	0.12 (0.03, 0.47)	0.003
Clinical severity										
Low	REF		REF		REF		REF		REF	
Moderate	1.06 (0.91, 1.24)	0.46	1.21 (1.02, 1.44)	0.03	0.98 (0.85, 1.14)	0.84	0.89 (0.56, 1.41)	0.61	1.05 (0.74, 1.50)	0.77
High	1.13 (0.96, 1.33)	0.15	1.33 (1.10, 1.60)	0.004	0.99 (0.83, 1.19)	0.95	0.74 (0.48, 1.14)	0.16	0.65 (0.41, 1.03)	0.07
Functional impairment										
None/low	REF		REF		REF		REF		REF	
Moderate	1.02 (0.86, 1.22)	0.78	0.95 (0.71, 1.27)	0.71	0.87 (0.69, 1.10)	0 .23	1.78 (0.80, 3.96)	0.16	0.85 (0.47, 1.56)	0.60
High	1.08 (0.84, 1.38)	0.55	0.85 (0.58, 1.25)	0.40	0.96 (0.71, 1.31)	0.80	1.30 (0.49, 3.45)	0.59	0.73 (0.42, 1.30)	0.28
Cognitive impairment	1.06 (0.93, 1.22)	0.38	1.13 (0.94, 1.34)	0.18	1.11 (0.92, 1.35)	0.26	1.12 (0.73, 1.73)	0.60	0.76 (0.55, 1.06)	0.10
Pressure ulcer	1.32 (1.05, 1.65)	0.02	2.00 (1.42, 2.82)	<0.001	1.22 (0.78, 1.90)	0.38	0.70 (0.22, 2.19)	0.53	1.15 (0.24, 5.45)	0.86
Wound	1.04 (0.86, 1.26)	0.69	1.32 (1.05, 1.67)	0.02	0.84 (0.66, 1.06)	0.13	0.77 (0.40, 1.48)	0.43	0.86 (0.61, 1.22)	0.40
Home Health Provider Characteristics										
Nonprofit	0.82 (0.71, 0.95)	0.009	0.84 (0.70, 1.00)	0.05	0.76 (0.63, 0.90)	0.004	1.24 (0.76, 2.03)	0.38	0.80 (0.58, 1.10)	0.17

* Data drawn from National Health and Aging Trends Study (NHATS) and linked Outcomes and Assessment Information Set (OASIS) data for 1,519 Medicare beneficiaries receiving family caregiver assistance with household chores during home health, 2011-2016.
† Incidence Rate Ratio.

Table A11. Effect of family caregiver's need for self-care task training on incidence of visits during Medicare home health episode, by visit type (n=1,384 unweighted, n=6,480,207 weighted)*

	Total Visits		Nursing Visits		Therapy Visits		Aide Visits		Training Visits	
	IRR† (95% CI)	p-value	IRR (95% CI)	p-value	IRR (95% CI	p-value	IRR (95% CI	p-value	IRR (95% CI	p-value
Family caregiver needs training on self-care tasks	1.10 (0.97, 1.25)	0.15	0.98 (0.85, 1.13)	0.75	1.02 (0.91, 1.15)	0.71	0.93 (0.73, 1.18)	0.54	1.11 (0.86,1.41)	0.42
Older Adult Characteristics										
Age	1.00 (1.00, 1.01)	0.34	1.01 (0.98, 1.02)	0.17	1.00 (0.99, 1.01)	0.65	1.01 (0.98,1.04)	0.50	1.01 (1.00,1.03)	0.13
Male sex	1.07 (0.94, 1.23)	0.29	1.25 (1.09, 1.44)	0.002	1.10 (0.94, 1.29)	0.22	1.13 (0.76,1.69)	0.54	1.24 (0.92,1.67)	0.15
Non-white race	0.85 (0.74, 0.99)	0.03	0.98 (0.80, 1.21)	0.87	0.82 (0.68, 0.97)	0.02	1.66 (1.01,2.74)	0.05	1.07 (0.73,1.57)	0.74
Medicaid-enrolled	1.10 (0.94, 1.28)	0.25	1.11 (0.92, 1.34)	0.27	1.16 (0.96, 1.41)	0.12	1.51 (0.85,2.68)	0.16	0.78 (0.50,1.22)	0.27
Prior to Home Health										
Number of caregivers	1.02 (0.97, 1.08)	0.35	1.01 (0.95, 1.08)	0.78	1.02 (0.98, 1.07)	0.29	1.13 (0.99,1.29)	0.07	1.07 (0.97,1.19)	0.18
Receives medication management help	1.12 (0.93, 1.35)	0.24	1.13 (0.95, 1.35)	0.17	1.06 (0.84, 1.33)	0.62	1.13 (0.76,1.69)	0.54	1.10 (0.70,1.73)	0.68
Functional assistance:										
None	REF		REF		REF		REF		REF	
Household chores	1.13 (0.98, 1.31)	0.09	1.12 (0.93, 1.33)	0.23	1.07 (0.88, 1.29)	0.52	1.88 (1.16, 3.04)	0.01	0.76 (0.56,1.04)	0.08
Mobility	1.15 (0.91, 1.47)	0.24	1.27 (0.89, 1.82)	0.19	1.00 (0.78, 1.27)	0.99	1.08 (0.52, 2.25)	0.83	0.41 (0.16,1.04)	0.06
Self-care	1.11 (0.94, 1.33)	0.22	1.05 (0.87, 1.26)	0.60	1.06 (0.87, 1.30)	0.55	1.69 (0.90, 3.20)	0.10	0.87 (0.60,1.25)	0.44
Lives alone	1.21 (1.03, 1.42)	0.02	1.29 (1.05, 1.59)	0.02	1.12 (0.96, 1.31)	0.16	1.30 (0.80, 2.11)	0.29	1.00 (0.68,1.47)	0.99
Fallen in past year	1.06 (0.96, 1.17)	0.22	1.00 (0.88, 1.14)	0.96	1.03 (0.91, 1.16)	0.69	0.89 (0.62, 1.29)	0.54	0.87 (0.68,1.12)	0.28
Self-rated health:										
Excellent/very good	REF		REF		REF		REF		REF	

Good	1.02 (0.87, 1.19)	0.80	0.97 (0.82, 1.15)	0.70	1.09 (0.88, 1.35)	0.42	0.78 (0.55, 1.10)	0.15	0.87 (0.59,1.26)	0.45
Fair/poor	0.95 (0.81, 1.12)	0.54	0.91 (0.76, 1.10)	0.33	1.01 (0.83, 1.23)	0.92	0.80 (0.57, 1.13)	0.20	1.08 (0.77,1.51)	0.64
During Home Health										
Lives alone	0.89 (0.76,1.04)	0.15	0.86 (0.71,1.04)	0.12	0.87 (0.75,1.01)	0.07	1.33 (0.81,2.20)	0.25	0.93 (0.64,1.36)	0.72
Post-acute	0.97 (0.84,1.13)	0.71	0.89 (0.75,1.06)	0.18	0.99 (0.84,1.16)	0.87	0.94 (0.68,1.30)	0.69	0.73 (0.54,1.00)	0.05
Any respiratory therapy	1.05 (0.90,1.23)	0.50	1.23 (1.06,1.44)	0.008	0.87 (0.69,1.11)	0.26	1.97 (1.19,3.24)	0.009	1.0 (0.63,1.60)	0.99
Any IV therapy	0.39 (0.21,0.74)	0.005	0.72 (0.39,1.31)	0.28	0.21 (0.08,0.58)	0.003	3.82 (1.54,9.48)	0.005	0.14 (0.06,0.35)	<0.001
Clinical severity										
Low	REF		REF		REF		REF		REF	
Moderate	1.03 (0.90, 1.18)	0.68	1.21 (1.01, 1.45)	0.04	0.97 (0.84, 1.13)	0.74	0.93 (0.59,1.45)	0.75	0.96 (0.64,1.44)	0.84
High	1.15 (0.98, 1.34)	0.08	1.39 (1.15, 1.67)	0.001	1.06 (0.90, 1.24)	0.50	0.84 (0.59,1.21)	0.35	0.66 (0.45,0.97)	0.03
Functional impairment										
None/low	REF		REF		REF		REF		REF	
Moderate	1.01 (0.84, 1.22)	0.92	0.88 (0.66, 1.18)	0.38	0.87 (0.72, 1.06)	0.16	1.81 (0.87,3.76)	0.11	1.14 (0.65,1.99)	0.64
High	1.04 (0.82, 1.30)	0.76	0.74 (0.53, 1.04)	0.09	0.96 (0.74, 1.25)	0.78	1.21 (0.54,2.70)	0.63	1.16 (0.63,2.15)	0.62
Cognitive impairment	1.11 (0.98, 1.26)	0.10	1.22 (1.05, 1.43)	0.01	1.10 (0.96, 1.27)	0.18	1.05 (0.75,1.47)	0.79	0.85 (0.64,1.13)	0.25
Pressure ulcer	1.19 (0.96, 1.46)	0.11	1.77 (1.28, 2.44)	0.001	1.01 (0.69, 1.48)	0.95	1.05 (0.46,2.37)	0.91	1.20 (0.34,4.22)	0.77
Wound	1.05 (0.91, 1.22)	0.50	1.34 (1.11, 1.62)	0.001	0.87 (0.71, 1.07)	0.18	0.75 (0.48,1.18)	0.21	1.04 (0.75,1.44)	0.80
Home Health Provider Characteristics										
Nonprofit	0.80 (0.70, 0.93)	0.003	0.83 (0.70, 0.98)	0.03	0.74 (0.64, 0.86)	<0.001	1.32 (0.85,2.05)	0.22	0.69 (0.52,0.91)	0.01

* Data drawn from National Health and Aging Trends Study (NHATS) and linked Outcomes and Assessment Information Set (OASIS) data for 1,384 Medicare beneficiaries receiving family caregiver assistance with self-care tasks during home health, 2011-2016.
† Incidence Rate Ratio.

Table A12. Effect of family caregiver's need for medication management training on incidence of visits during Medicare home health episode, by visit type (n=1,217 unweighted, n=5,578,439 weighted)*

	Total Visits		Nursing Visits		Therapy Visits		Aide Visits		Training Visits	
	IRR† (95% CI)	p-value	IRR (95% CI)	p-value	IRR (95% CI	p-value	IRR (95% CI	p-value	IRR (95% CI	p-value
Caregiver needs training on medication management	1.03 (0.94,1.14)	0.48	1.16 (1.02,1.32)	0.03	0.96 (0.85,1.08)	0.48	0.81 (0.57,1.15)	0.23	0.97 (0.78,1.21)	0.78
Older Adult Characteristics										
Age	1.00 (0.99,1.01)	0.27	1.01 (1.00,1.01)	0.16	0.99 (0.99,1.01)	0.82	1.01 (0.98,1.03)	0.67	1.01 (0.99,1.03)	0.39
Male sex	1.04 (0.90,1.21)	0.59	1.24 (1.07,1.44)	0.006	1.09 (0.931.28)	0.29	1.28 (0.83,1.98)	0.26	1.06 (0.77,1.44)	0.72
Non-white race	0.89 (0.75,1.06)	0.19	0.98 (0.81,1.18)	0.80	0.87 (0.71,1.06)	0.16	1.64 (0.89,3.03)	0.11	1.05 (0.77,1.43)	0.74
Medicaid-enrolled	1.02 (0.85,1.22)	0.83	1.08 (0.90,1.30)	0.42	1.02 (0.83,1.26)	0.83	0.93 (0.59,1.48)	0.77	0.89 (0.62,1.29)	0.54
Prior to Home Health										
Number of caregivers	1.02 (0.97,1.07)	0.42	0.99 (0.95,1.05)	0.85	1.01 (0.97,1.05)	0.70	1.28 (1.17,1.40)	<0.001	1.05 (0.96,1.15)	0.26
Receives medication management help	1.05 (0.87,1.27)	0.61	1.07 (0.89,1.27)	0.47	0.96 (0.76,1.20)	0.69	1.00 (0.66,1.54)	0.98	1.13 (0.73,1.75)	0.59
Functional assistance:										
None	REF		REF		REF		REF		REF	
Household chores	1.05 (0.88,1.25)	0.59	1.05 (0.88,1.25)	0.57	0.98 (0.78,1.23)	0.88	1.56 (0.92,2.65)	0.10	0.87 (0.67,1.14)	0.30
Mobility	1.03 (0.82,1.30)	0.81	1.10 (0.76,1.59)	0.61	0.97 (0.78,1.22)	0.81	0.92 (0.42,2.00)	0.83	0.70 (0.40,1.21)	0.19
Self-care	1.11 (0.91,1.35)	0.29	1.08 (0.88,1.33)	0.46	1.04 (0.84,1.29)	0.72	1.40 (0.77,2.55)	0.27	0.97 (0.69,1.37)	0.88
Lives alone	1.21 (1.02,1.43)	0.03	1.18 (0.99,1.42)	0.07	1.19 (0.98,1.44)	0.08	1.16 (0.70,1.90)	0.56	0.95 (0.63,1.44)	0.82
Fallen in past year	1.07 (0.95,1.20)	0.28	1.01 (0.89,1.15)	0.85	0.98 (0.83,1.16)	0.81	0.78 (0.52,1.17)	0.22	0.87 (0.68,1.13)	0.29
Self-rated health:										
Excellent/very good	REF		REF		REF		REF		REF	

Good	1.01 (0.85, 1.19)	0.95	0.94 (0.80,1.11)	0.47	1.07 (0.90,1.29)	0.43	0.66 (0.40,1.11)	0.12	0.89 (0.611.29)	0.52
Fair/poor	0.94 (0.80, 1.11)	0.49	0.90 (0.76,1.06)	0.22	1.00 (0.82,1.21)	0.96	0.90 (0.57,1.44)	0.67	0.95 (0.67,1.34)	0.76
During Home Health										
Lives alone	0.91 (0.76,1.10)	0.34	0.91 (0.76,1.09)	0.30	0.83 (0.68,1.02)	0.07	1.61 (1.11,2.33)	0.01	1.34 (1.00,1.79)	0.05
Post-acute	0.93 (0.80,1.07)	0.31	0.82 (0.69,0.97)	0.02	0.96 (0.83,1.12)	0.62	0.75 (0.55,1.01)	0.06	0.67 (0.49,0.91)	0.01
Any respiratory therapy	1.01 (0.89,1.15)	0.82	1.22 (1.08,1.37)	0.002	0.82 (0.65,1.02)	0.08	1.76 (1.13, 2.75)	0.01	1.24 (0.89,1.74)	0.21
Any IV therapy	0.54 (0.27,1.08)	0.08	0.98 (0.52,1.83)	0.95	0.38 (0.17,0.85)	0.02	2.09 (0.75,5.85)	0.16	0.12 (0.05,0.27)	<0.001
Clinical severity										
Low	REF		REF		REF		REF		REF	
Moderate	1.11 (0.94,1.31)	0.23	1.30 (1.08,1.56)	0.006	1.01 (0.85,1.21)	0.87	1.14 (0.721.80)	0.57	1.17 (0.81,1.69)	0.39
High	1.18 (0.99,1.42)	0.07	1.34 (1.14,1.58)	0.001	1.07 (0.90,1.28)	0.43	0.85 (0.56,1.29)	0.44	0.91 (0.62,1.33)	0.63
Functional impairment										
None/low	REF		REF		REF		REF		REF	
Moderate	1.10 (0.91,1.33)	0.32	0.91 (0.72,1.15)	0.41	0.90 (0.69,1.19)	0.46	1.62 (0.69,3.81)	0.26	1.26 (0.68,2.34)	0.45
High	1.22 (0.97,1.55)	0.09	0.80 (0.59,1.09)	0.15	1.08 (0.79,1.47)	0.62	1.24 (0.47,3.25)	0.66	1.45 (0.78,2.72)	0.24
Cognitive impairment	1.09 (0.97,1.22)	0.14	1.06 (0.94,1.20)	0.33	1.14 (0.99,1.31)	0.07	0.98 (0.75,1.28)	0.89	0.92 (0.75,1.13)	0.44
Pressure ulcer	1.26 (0.99,1.60)	0.05	1.74 (1.31,2.32)	<0.001	1.03 (0.67,1.60)	0.88	1.91 (0.86,4.26)	0.11	1.69 (0.60,4.76)	0.32
Wound	1.02 (0.86,1.21)	0.78	1.31 (1.07,1.59)	0.009	0.81 (0.67,0.98)	0.03	0.92 (0.56,1.51)	0.74	0.99 (0.72,1.37)	0.96
Home Health Provider Characteristics										
Nonprofit	0.83 (0.71,0.96)	0.01	0.90 (0.77,1.07)	0.23	0.76 (0.65,0.89)	0.001	0.87 (0.54,1.40)	0.57	0.80 (0.60,1.07)	0.13

*Data drawn from National Health and Aging Trends Study (NHATS) and linked Outcomes and Assessment Information Set (OASIS) data for 1,217 Medicare beneficiaries receiving family caregiver assistance with medication management during home health 2011-2016.
† Incidence Rate Ratio.

Table A13. Effect of family caregiver's need for patient supervision training on incidence of visits during Medicare home health episode, by visit type (n=1,061 unweighted, n=4,870,844 weighted)*

	Total Visits		Nursing Visits		Therapy Visits		Aide Visits		Training Visits	
	IRR† (95% CI)	p-value	IRR (95% CI)	p-value	IRR (95% CI	p-value	IRR (95% CI	p-value	IRR (95% CI	p-value
Caregiver needs training on patient supervision	1.00 (0.88, 1.14)	0.96	1.13 (0.96,1.32)	0.15	0.85 (0.72, 1.00)	0.06	0.79 (0.51,1.23)	0.29	0.95 (0.72,1.24)	0.69
Older Adult Characteristics										
Age	1.00 (0.99, 1.01)	0.91	1.00 (0.99, 1.02)	0.68	0.99 (0.98,1.00)	0.26	1.02 (0.99,1.05)	0.29	1.01 (0.98,1.04)	0.61
Male sex	1.08 (0.93, 1.26)	0.32	1.23 (1.06, 1.43)	0.007	1.09 (0.90,1.33)	0.37	1.08 (0.66,1.78)	0.76	1.05 (0.711.55)	0.79
Non-white race	0.89 (0.74, 1.07)	0.21	0.99 (0.81, 1.23)	0.96	0.87 (0.68,1.09)	0.22	2.21 (1.14,4.27)	0.02	0.87 (0.58, 1.30)	0.49
Medicaid-enrolled	0.89 (0.73, 1.09)	0.25	1.02 (0.85, 1.22)	0.85	0.89 (0.70,1.13)	0.32	0.63 (0.32,1.27)	0.20	1.04 (0.58,1.85)	0.89
Prior to Home Health										
Number of caregivers	1.01 (0.94,1.07)	0.88	1.00 (0.94,1.05)	0.88	1.01 (0.95,1.08)	0.73	1.11 (0.93,1.32)	0.23	1.13 (1.00,1.27)	0.05
Receives medication management help	1.05 (0.86,1.27)	0.63	1.07 (0.87,1.31)	0.51	0.95 (0.75,1.20)	0.65	0.76 (0.49,1.18)	0.21	1.13 (0.74,1.75)	0.56
Functional assistance:										
None	REF				REF					
Household chores	1.21 (1.03,1.42)	0.02	1.16 (0.94,1.42)	0.16	1.09 (0.85,1.39)	0.48	1.70 (0.90,3.22)	0.10	1.08 (0.76,1.52)	0.67
Mobility	1.24 (0.97,1.58)	0.08	1.23 (0.82,1.85)	0.31	1.04 (0.82,1.32)	0.72	1.36 (0.52,3.60)	0.52	0.41 (0.19,0.89)	0.02
Self-care	1.32 (1.09, 1.60)	0.006	1.10 (0.87,1.38)	0.42	1.21 (0.97,1.52)	0.09	2.67 (1.33,5.37)	0.007	1.14 (0.75,1.72)	0.54
Lives alone	1.24 (1.02,1.52)	0.04	1.14 (0.89,1.47)	0.28	1.19 (0.95,1.48)	0.13	1.32 (0.88,1.98)	0.18	1.63 (0.89,3.02)	0.11
Fallen in past year	1.02 (0.91,1.16)	0.69	1.00 (0.87,1.14)	0.98	0.95 (0.82,1.10)	0.47	0.68 (0.46,1.03)	0.07	0.85 (0.66,1.10)	0.21
Self-rated health:										
Excellent/very good	REF									

Good	0.93 (0.75, 1.16)	0.52	0.92 (0.76, 1.11)	0.40	1.03 (0.78, 1.37)	0.83	0.81 (0.50,1.32)	0.39	1.10 (0.691.61)	0.80
Fair/poor	0.96 (0.80, 1.16)	0.68	0.92 (0.76, 1.12)	0.40	1.08 (0.84, 1.39)	0.53	0.82 (0.48,1.38)	0.44	1.21 (0.81,1.80)	0.34
During Home Health										
Lives alone	0.92 (0.78,1.10)	0.36	0.95 (0.78,1.14)	0.56	0.84 (0.70,1.01)	0.07	1.26 (0.79,1.99)	0.32	0.92 (0.54,1.54)	0.74
Post-acute	0.91 (0.76,1.09)	0.30	0.79 (0.66,0.94)	0.01	0.91 (0.74,1.12)	0.38	0.89 (0.611.32)	0.57	0.48 (0.28,0.82)	0.009
Any respiratory therapy	0.95 (0.79,1.14)	0.58	1.07 (0.85,1.35)	0.58	0.75 (0.59,0.96)	0.02	1.94 (0.93,4.06)	0.08	1.11 (0.71,1.72)	0.65
Any IV therapy	0.27 (0.13,0.57)	0.001	0.46 (0.24,0.88)	0.02	0.24 (0.07,0.86)	0.03	1.52 (0.29,4.72)	0.46	0.18 (0.06,0.55)	0.003
Clinical severity										
Low	REF									
Moderate	1.12 (0.93,1.36)	0.22	1.36 (1.09,1.71)	0.008	1.02 (0.83,1.27)	0.83	1.06 (0.57,1.98)	0.85	1.31 (0.93,1.84)	0.12
High	1.26 (1.03,1.54)	0.03	1.44 (1.16,1.77)	0.001	1.05 (0.88,1.26)	0.55	1.02 (0.62,1.69)	0.94	0.86 (0.56,1.32)	0.48
Functional impairment										
None/low	REF									
Moderate	1.06 (0.86,1.20)	0.59	1.01 (0.79,1.28)	0.95	0.84 (0.60,1.19)	0.32	1.19 (0.55,2.60)	0.66	1.15 (0.62,2.14)	0.66
High	1.08 (0.82,1.43)	0.58	0.84 (0.61,1.16)	0.28	0.96 (0.65,1.41)	0.82	0.99 (0.402.44)	0.98	1.06 (0.49,2.32)	0.87
Cognitive impairment	1.11 (0.97,1.26)	0.12	1.07 (0.90,1.27)	0.44	1.17 (1.02,1.35)	0.03	1.21 (0.86,1.70)	0.26	0.75 (0.53,1.08)	0.12
Pressure ulcer	1.22 (0.96,1.54)	0.10	1.74 (1.27,2.37)	0.001	0.94 (0.65,1.36)	0.73	0.89 (0.35,2.28)	0.80	1.45 (0.32,6.48)	0.62
Wound	1.07 (0.91,1.26)	0.42	1.28 (1.02,1.60)	0.03	0.86 (0.70,1.05)	0.14	0.93 (0.49,1.77)	0.82	0.76 (0.50,1.16)	0.20
Home Health Provider Characteristics										
Nonprofit	0.81 (0.69,0.96)	0.02	0.90 (0.75,1.09)	0.28	0.76 (0.63,0.92)	0.005	1.01 (0.59,1.73)	0.97	0.64 (0.47,0.86)	0.005

* Data drawn from National Health and Aging Trends Study (NHATS) and linked Outcomes and Assessment Information Set (OASIS) data for 1,061 Medicare beneficiaries receiving family caregiver assistance with patient supervision during home health, 2011-2016.
† Incidence Rate Ratio.

A2.2. Sensitivity Analyses

As sensitivity analyses, we duplicated all regression analyses without propensity score adjustment. These regression results are presented in Tables A14 and A15 below. Additionally, we used an approach developed by Greenland (1996) to estimate the relationships between predictor and outcome variables while adjusting for a possible unobserved confounder. These results are presented in Table A16, below.

Table A14. Effect of family caregiver's need for task-specific training on odds of receiving visits during a Medicare home health episode, by visit type (n=1,217 unweighted, n=5,870,905 weighted)*

	Home Health Visit Type							
	Nursing Visits		Therapy Visits		Aide Visits		Training Visits	
	aOR† (95% CI)	p-value	aOR (95% CI)	p-value	aOR (95% CI)	p-value	aOR (95% CI)	p-value
Family caregiver needs training on:								
Household chores	2.25 (0.74, 6.80)	0.15	0.85 (0.45, 1.61)	0.61	2.48 (1.36, 4.53)	0.004	1.01 (0.61, 1.68)	0.95
Self-care	1.32 (0.71, 2.44)	0.38	1.51 (0.92, 2.47)	0.10	2.04 (1.09, 3.85)	0.03	1.41 (0.99, 2.01)	0.06
Medication management	2.97 (0.97, 9.13)	0.06	0.91 (0.51, 1.63)	0.74	1.08 (0.59, 1.99)	0.80	1.43 (0.95, 2.15)	0.09
Patient supervision	1.52 (0.53, 4.33)	0.43	1.33 (0.71, 2.48)	0.37	1.01 (0.49, 2.08)	0.98	1.12 (0.71, 1.79)	0.61

* Adjusted for: older adults' sociodemographic characteristics (age, sex, race, Medicaid enrollment), receipt of caregiver assistance (number of caregivers, help with medications, level of functional assistance), and health and functional status (fallen in prior year, self-rated overall health) prior to home health, older adults' health and functional status (clinical severity, post-acute status, functional impairment, cognitive impairment, receipt of any respiratory or IV therapies, presence of ulcer or wound), and home health provider nonprofit status.
† Adjusted Odds Ratio.

Table A15. Marginal effect of family caregiver's need for task-specific training on expected number of visits during Medicare home health episode, by visit type (n=1,217 unweighted, n=5,870,905 weighted)*

	Home Health Visit Type									
	Total Visits		Nursing Visits		Therapy Visits		Aide Visits		Training Visits	
	Expected add'l visits (95% CI)	p-value	Expected add'l visits (95% CI)	p-value	Expected add'l visits (95% CI	p-value	Expected add'l visits (95% CI	p-value	Expected add'l visits (95% CI	p-value
Family caregiver needs training on:										
Household chores	3.15 (0.06, 6.25)	0.05	0.99 (-0.44, 2.41)	0.17	0.91 (-1.19, 3.00)	0.39	1.16 (0.19, 2.12)	0.02	-0.14 (-0.73, 0.45)	0.64
Self-care	1.82 (-0.31, 3.95)	0.09	-0.01 (-0.94, 0.92)	0.99	1.37 (0.05, 2.69)	0.04	0.73 (-0.09, 1.55)	0.08	0.33 (-0.16, 0.82)	0.18
Medication management	0.84 (-0.74, 2.41)	0.29	1.04 (0.09, 1.99)	0.03	<0.001 (-1.15, 1.15)	1.00	-0.11 (-1.02, 0.80)	0.82	0.40 (-0.16, 0.95)	0.16
Patient supervision	0.11 (-2.08, 2.31)	0.92	0.73 (-0.42, 1.88)	0.21	-0.32 (-2.19, 1.54)	0.73	-0.21 (-1.10, 0.64)	0.63	0.09 (-0.46, 0.64)	0.75

* Holding all covariates at their means. Covariates include: older adults' sociodemographic characteristics (age, sex, race, Medicaid enrollment), receipt of caregiver assistance (number of caregivers, help with medications, level of functional assistance), and health and functional status (fallen in prior year, self-rated overall health). prior to home health, older adults' health and functional status (clinical severity, post-acute status, functional impairment, cognitive impairment, receipt of any respiratory or IV therapies, presence of ulcer or wound), and home health provider nonprofit status.

Table A16. Estimated relationship of family caregiver's need for task-specific training on odds of receiving visits during a Medicare home health episode while controlling for a potential unobserved confounder, by visit type (n=1,217 unweighted, n=5,870,905 weighted)*

Family caregiver needs training on:	Prevalence of unobserved confounder in untreated group:	Home Health Visit Type: Nursing Visits aOR† (95% CI)	Nursing Visits p-value	Therapy Visits aOR (95% CI)	Therapy Visits p-value	Aide Visits aOR (95% CI)	Aide Visits p-value	Training Visits aOR (95% CI)	Training Visits p-value
Household chores	5%	1.97 (0.94, 4.16)	0.07	1.21 (0.75, 1.93)	0.43	2.76 (1.84, 4.14)	<0.001	1.17 (0.79, 1.72)	.43
	10%	2.07 (0.98, 4.36)	0.06	1.23 (0.77, 1.97)	0.39	2.70 (1.79, 4.05)	<0.001	2.70 (1.79, 4.05)	<.0.001
	20%	2.27 (1.07, 4.81)	0.03	1.26 (0.79, 2.03)	0.34	2.57 (1.71, 3.88)	<0.001	2.59 (1.72, 3.91)	<0.001
Self-care tasks	5%	1.22 (0.75, 1.99)	0.43	1.87 (1.26, 2.79)	0.002	2.05 (1.44, 2.91)	<0.001	1.26 (0.94, 1.71)	0.13
	10%	1.25 (0.76, 2.05)	0.37	1.89 (1.27, 2.81)	0.002	1.90 (1.33, 2.71)	<0.001	1.21 (0.89, 1.64)	0.22
	20%	1.31 (0.79, 2.16)	0.29	1.92 (1.29, 2.87)	0.001	1.71 (1.19, 2.46)	0.004	1.15 (0.84, 1.56)	0.38
Medication management	5%	4.90 (2.10, 11.47)	<0.001	0.88 (0.61, 1.28)	0.52	1.05 (0.72, 1.53)	0.81	1.42 (1.04, 1.93)	0.03
	10%	5.06 (2.16, 11.86)	<0.001	0.89 (0.62, 1.29)	0.55	0.96 (0.65, 1.41)	0.83	1.38 (1.01, 1.88)	0.05
	20%	5.51 (2.33, 13.00)	<0.001	0.90 (0.62, 1.31)	0.59	0.88 (0.59, 1.29)	0.50	1.33 (0.97, 1.82)	0.08
Patient supervision	5%	1.11 (0.58, 2.14)	0.75	1.06 (0.67, 1.69)	0.81	0.89 (0.56, 1.42)	0.63	0.93 (0.63, 1.39)	0.74
	10%	1.15 (0.60, 2.21)	0.68	1.06 (0.67, 1.69)	0.80	0.80 (0.50, 1.30)	0.37	0.89 (0.59, 1.32)	0.56
	20%	1.21 (0.62, 2.34)	0.58	1.09 (0.68, 1.73)	0.73	------§		0.83 (0.55, 1.25)	0.37

* Data are drawn from National Health and Aging Trends Study (NHATS) and linked Outcomes and Assessment Information Set (OASIS) and Medicare claims data for 1,217 Medicare beneficiaries receiving family caregiver assistance during home health, 2011-2016.

† Adjusted Odds Ratio.

§ Not available due to negative frequency weights.

A2.3. Calculations of Estimated Cost to Medicare of Family Caregiver Need for Training during Home Health

Using estimated national average per-visit payment amounts for Medicare home health in 2020, we are able to estimate the cost to Medicare of the additional visits associated with family caregiver need for training. Patients whose family caregiver needed training on household chores incurred 1.32 additional aide visits, leading to an additional per-episode cost of $89.47 ($67.78*1.32).[93] Those whose family caregiver needed training on medication management incurred 1.06 additional nursing visits, leading to an additional per-episode cost of $158.66 ($149.68*1.06).[93] Multiplied across home health episodes in which family caregivers have an identified need for training, we estimate that family caregiver need for training on household chores and medication management respectively cost Medicare an additional $33.5 million and $102.3 million annually. We arrive at these figures by multiplying the number of Medicare beneficiaries who incur at least one home health episode annually (3.4 million),[19] by the proportion of home health patients who require family caregiver assistance (84.7% with household chores, 65.2% with medication management),[23] by the proportion of family caregivers with identified need for training during home health (13.0% with household chores, 29.1% with medication management),[87] and finally by the estimated additional cost per episode associated with family caregiver need for training ($89.47 for household chores, $158.66 for medication management). See Table A17 below for exact figures.

Table A17. Calculations of Estimated Cost to Medicare of Family Caregiver Need for Training during Home Health

	Caregiving Activity:	
	Household chores	Medication management
Number of Medicare home health users annually:	3,400,000	3,400,000
Number requiring caregiver assistance:	2,879,800 (3,400,000*0.847)	2,216,800 (3,400,000*0.652)
Number whose caregiver has an identified need for training:	374,374 (2,879,800*0.13)	645,088 (2,216,800*0.291)
Total additional cost:	$33,495,241.78 (374,374*$89.47)	$102,349,789.01 (645,088*$158.66)

APPENDIX 3: "Chapter Five: Family Caregivers' Unmet Need for Training and Acute Care Utilization among Medicare Beneficiaries Receiving Home Health"

A3.1 Full Regression Results

Table A18, below, presents a summary of main findings from our analyses: the adjusted odds ratios of acute care utilization during home health, comparing older adults with unmet need for family caregiver training to those without unmet need for family caregiver training.

Table A18. Unmet Need for Activity-Specific Family Caregiver Training and Odds of Acute Care Utilization, among Older Adults Receiving Family Caregiver Assistance during Medicare Home Heath Care (n=1,217 unweighted, n=5,870,905 weighted)*

Unmet Family Caregiver Need for Training with:	Adjusted Odds of Acute Care Utilization during Home Health Episode† aOR (95% CI)	p-value
Household chores	1.98 (1.13, 3.46)	0.02
Self-care	3.11 (1.62, 6.00)	0.001
Medication management	2.50 (1.46, 4.26)	0.001
Patient supervision	2.92 (1.36, 6.24)	0.007
Any of these four activities	2.01 (1.20, 3.38)	0.009

* Data are drawn from National Health and Aging Trends Study (NHATS) and linked Outcomes and Assessment Information Set (OASIS), Medicare claims data, and Provider of Services data for 1,217 Medicare beneficiaries receiving family caregiver assistance during a home health episode between 2011-2016.

† Adjusted for: measures of older adults' sociodemographic characteristics (age, sex, race, Medicaid-enrollment), health status (self-reported overall health status and prior year hospitalization), and receipt of family caregiver assistance (help with household chores, mobility tasks, or self-care tasks) prior to home health; older adults' living arrangement (whether they lived alone), post-acute status (whether they received inpatient care within 14 days of home health care), care intensity (receipt of any respiratory therapy or any IV treatment, number of nursing visits received, receipt of any therapy visits), clinical severity, functional impairment, and cognitive impairment during home health; and home health provider non-profit status, number of full-time equivalent employees, and affiliation with any acute care hospital.

Tables A19-A23, below, include full results of weighted, multivariable logistic regressions modelling the relationship of unmet need for family caregiver training and odds of acute care utilization, across five caregiving activities.

Table A19. Unmet Need for Family Caregiver Training with Household Chores and Odds of Acute Care Utilization, among Older Adults Receiving Family Caregiver Assistance during Medicare Home Heath Care (n=932 unweighted, n=4,307,528 weighted)*

Older adult and home health provider characteristics:	Adjusted Odds of Acute Care Utilization during Home Health Episode aOR (95% CI)	p-value
Unmet Family Caregiver Need for Training with Household chores	3.11 (1.62, 6.00)	0.001
Age	1.02 (0.98, 1.05)	0.30
Male sex	1.48 (0.86, 2.52)	0.15
Non-white race	0.89 (0.51, 1.54)	0.67
Medicaid-enrolled	1.09 (0.64, 1.87)	0.75
Self-reported overall health status		
Fair/poor	REF	
Good	0.67 (0.37, 1.22)	0.19
Very good/excellent	0.99 (0.58, 1.70)	0.98
Hospitalized in past year	2.10 (1.33, 3.32)	0.002
Level of functional assistance received		
None	REF	
Household chores only	0.88 (0.50, 1.55)	0.66
Mobility tasks	1.77 (0.75, 4.18)	0.19
Self-care tasks	0.91 (0.49, 1.69)	0.77
Lives alone during home health	1.11 (0.68, 1.82)	0.66
Post-acute	1.06 (0.62, 1.84)	0.82
Receives respiratory therapy	1.50 (0.87, 2.59)	0.14
Receives IV therapy	1.76 (0.45, 6.86)	0.41
Clinical severity		
Low	REF	
Moderate	0.97 (0.55, 1.70)	0.91
High	1.52 (0.85, 2.74)	0.16
Functional Impairment		
None/low	REF	
Moderate	1.45 (0.66, 3.16)	0.35
High	1.69 (0.72, 3.97)	0.22
Cognitive impairment	0.74 (0.49, 1.12)	0.15
Non-profit home health provider	1.16 (0.73, 1.85)	0.52
Number of full-time equivalent employees	1.00 (0.99, 1.00)	0.99
Hospital-affiliated home health provider	0.70 (0.40, 1.26)	0.23
Number of nursing visits	1.01 (0.98, 1.04)	0.63
Receives therapy visits	0.77 (0.46, 1.30)	0.33

* Data are drawn from National Health and Aging Trends Study (NHATS) and linked Outcomes and Assessment Information Set (OASIS), Medicare claims data, and Provider of Services data for 1,217 Medicare beneficiaries receiving family caregiver assistance during a home health episode between 2011-2016.

Table A20. Unmet Need for Family Caregiver Training with Self-Care Tasks and Odds of Acute Care Utilization, among Older Adults Receiving Family Caregiver Assistance during Medicare Home Heath Care (n=851 unweighted, n=3,914,765 weighted)*

Older adult and home health provider characteristics:	Adjusted Odds of Acute Care Utilization during Home Health Episode aOR (95% CI)	p-value
Unmet family caregiver need for training with self-care tasks	1.98 (1.13, 3.46)	0.02
Age	1.02 (0.98, 1.05)	0.29
Male sex	1.56 (0.88, 2.76)	0.12
Non-white race	0.86 (0.49, 1.53)	0.61
Medicaid-enrolled	1.11 (0.61, 2.01)	0.73
Self-reported overall health status		
Fair/poor	REF	
Good	0.68 (0.36, 1.29)	0.23
Very good/excellent	1.07 (0.59, 1.93)	0.82
Hospitalized in past year	2.12 (1.36, 3.32)	0.001
Level of functional assistance received		
None	REF	
Household chores only	0.81 (0.46, 1.41)	0.45
Mobility tasks	1.61 (0.69, 3.78)	0.27
Self-care tasks	0.81 (0.43, 1.51)	0.50
Lives alone during home health	1.21 (0.73, 1.99)	0.45
Post-acute	1.29 (0.75, 2.21)	0.35
Receives respiratory therapy	1.32 (0.76, 2.30)	0.31
Receives IV therapy	1.70 (0.40, 7.16)	0.46
Clinical severity		
Low	REF	
Moderate	1.04 (0.55, 1.97)	0.90
High	1.74 (0.88, 3.44)	0.11
Functional Impairment		
None/low	REF	
Moderate	1.92 (0.71, 5.16)	0.19
High	2.21 (0.79, 6.13)	0.13
Cognitive impairment	0.76 (0.48, 1.22)	0.25
Non-profit home health provider	1.04 (0.64, 1.68)	0.87
Number of full-time equivalent employees	1.00 (0.99, 1.00)	0.85
Hospital-affiliated home health provider	0.70 (0.37, 1.31)	0.26
Number of nursing visits	1.01 (0.98, 1.05)	0.49
Receives therapy visits	0.75 (0.43, 1.32)	0.32

* Data are drawn from National Health and Aging Trends Study (NHATS) and linked Outcomes and Assessment Information Set (OASIS), Medicare claims data, and Provider of Services data for 1,217 Medicare beneficiaries receiving family caregiver assistance during a home health episode between 2011-2016.

Table A21. Unmet Need for Family Caregiver Training with Medication Management and Odds of Acute Care Utilization, among Older Adults Receiving Family Caregiver Assistance during Medicare Home Heath Care (n=759 unweighted, n=3,441,634 weighted)*

Older adult and home health provider characteristics:	Adjusted Odds of Acute Care Utilization during Home Health Episode aOR (95% CI)	p-value
Unmet Family Caregiver Need for Training with Medication management	2.50 (1.46, 4.26)	0.001
Age	1.03 (0.99, 1.07)	0.11
Male sex	1.71 (0.93, 3.15)	0.09
Non-white race	1.15 (0.65, 2.01)	0.63
Medicaid-enrolled	1.16 (0.63, 2.13)	0.63
Self-reported overall health status		
Fair/poor	REF	
Good	0.62 (0.33, 1.16)	0.13
Very good/excellent	1.07 (0.57, 2.00)	0.84
Hospitalized in past year	1.90 (1.24, 2.92)	0.004
Level of functional assistance received		
None	REF	
Household chores only	0.83 (0.46, 1.49)	0.53
Mobility tasks	2.08 (0.81, 5.37)	0.13
Self-care tasks	0.94 (0.47, 1.89)	0.86
Lives alone during home health	1.05 (0.61, 1.79)	0.87
Post-acute	1.41 (0.81, 2.45)	0.22
Receives respiratory therapy	1.18 (0.64, 2.18)	0.60
Receives IV therapy	1.27 (0.31, 5.14)	0.74
Clinical severity		
Low	REF	
Moderate	1.12 (0.58, 2.14)	0.74
High	1.84 (0.91, 3.72)	0.09
Functional Impairment		
None/low	REF	
Moderate	1.75 (0.79, 3.91)	0.17
High	2.09 (0.91, 4.79)	0.08
Cognitive impairment	0.71 (0.46, 1.11)	0.13
Non-profit home health provider	1.34 (0.82, 2.21)	0.24
Number of full-time equivalent employees	1.00 (0.99, 1.00)	0.55
Hospital-affiliated home health provider	0.55 (0.26, 1.15)	0.11
Number of nursing visits	1.01 (0.97, 1.05)	0.71
Receives therapy visits	0.70 (0.40, 1.20)	0.19

* Data are drawn from National Health and Aging Trends Study (NHATS) and linked Outcomes and Assessment Information Set (OASIS), Medicare claims data, and Provider of Services data for 1,217 Medicare beneficiaries receiving family caregiver assistance during a home health episode between 2011-2016.

Table A22. Unmet Need for Family Caregiver Training with Patient Supervision and Odds of Acute Care Utilization, among Older Adults Receiving Family Caregiver Assistance during Medicare Home Heath Care (n=657 unweighted, n=2,983,494 weighted)*

Older adult and home health provider characteristics:	Adjusted Odds of Acute Care Utilization during Home Health Episode aOR (95% CI)	p-value
Unmet family caregiver need for training with patient supervision	2.92 (1.36, 6.24)	0.007
Age	1.02 (0.98, 1.06)	0.41
Male sex	1.66 (0.85, 3.26)	0.14
Non-white race	0.91 (0.51, 1.61)	0.74
Medicaid-enrolled	1.28 (0.62, 2.65)	0.49
Self-reported overall health status		
Fair/poor	REF	
Good	0.70 (0.35, 1.39)	0.30
Very good/excellent	1.23 (0.59, 2.57)	0.57
Hospitalized in past year	2.08 (1.29, 3.36)	0.003
Level of functional assistance received		
None	REF	
Household chores only	0.76 (0.39, 1.45)	0.40
Mobility tasks	1.06 (0.40, 2.84)	0.90
Self-care tasks	0.81 (0.41, 1.63)	0.55
Lives alone during home health	1.17 (0.67, 2.03)	0.57
Post-acute	1.16 (0.63, 2.12)	0.63
Receives respiratory therapy	1.22 (0.61, 2.47)	0.57
Receives IV therapy	2.47 (0.45, 13.58)	0.29
Clinical severity		
Low	REF	
Moderate	0.58 (0.27, 1.27)	0.17
High	0.95 (0.44, 2.06)	0.89
Functional Impairment		
None/low	REF	
Moderate	1.26 (0.50, 3.18)	0.61
High	1.58 (0.64, 3.95)	0.32
Cognitive impairment	0.78 (0.49, 1.24)	0.29
Non-profit home health provider	1.53 (0.86, 2.73)	0.15
Number of full-time equivalent employees	1.00 (0.99, 1.00)	0.76
Hospital-affiliated home health provider	0.53 (0.23, 1.23)	0.14
Number of nursing visits	1.02 (0.98, 1.07)	0.33
Receives therapy visits	0.84 (0.46, 1.53)	0.56

* Data are drawn from National Health and Aging Trends Study (NHATS) and linked Outcomes and Assessment Information Set (OASIS), Medicare claims data, and Provider of Services data for 1,217 Medicare beneficiaries receiving family caregiver assistance during a home health episode between 2011-2016.

Table A23. Unmet Need for Family Caregiver Training with Any Caregiving Activity and Odds of Acute Care Utilization, among Older Adults Receiving Family Caregiver Assistance during Medicare Home Heath Care (n=1,050 unweighted, n=4,961,350 weighted)*

Older adult and home health provider characteristics:	Adjusted Odds of Acute Care Utilization during Home Health Episode aOR (95% CI)	p-value
Unmet family caregiver need for training with any activity	2.01 (1.20, 3.38)	0.009
Age	1.02 (0.98, 1.05)	0.30
Male sex	1.35 (0.79, 2.31)	0.27
Non-white race	0.88 (0.53, 1.46)	0.62
Medicaid-enrolled	1.00 (0.58, 1.73)	0.99
Self-reported overall health status		
Fair/poor	REF	
Good	0.62 (0.36, 1.05)	0.08
Very good/excellent	0.96 (0.58, 1.59)	0.87
Hospitalized in past year	1.75 (1.16, 2.65)	0.008
Level of functional assistance received		
None	REF	
Household chores only	0.89 (0.54, 1.45)	0.63
Mobility tasks	1.51 (0.68, 3.37)	0.31
Self-care tasks	0.96 (0.53, 1.75)	0.90
Lives alone during home health	1.36 (0.86, 2.15)	0.19
Post-acute	1.26 (0.79, 2.02)	0.33
Receives respiratory therapy	1.25 (0.73, 2.15)	0.42
Receives IV therapy	1.27 (0.32, 5.04)	0.73
Clinical severity		
Low	REF	
Moderate	1.23 (0.73, 2.09)	0.43
High	1.86 (1.08, 3.20)	0.03
Functional Impairment		
None/low	REF	
Moderate	1.31 (0.63, 2.71)	0.47
High	1.50 (0.65, 3.45)	0.33
Cognitive impairment	0.83 (0.56, 1.23)	0.34
Non-profit home health provider	1.25 (0.80, 1.95)	0.32
Number of full-time equivalent employees	1.00 (0.99, 1.00)	0.33
Hospital-affiliated home health provider	0.67 (0.39, 1.15)	0.14
Number of nursing visits	1.02 (0.99, 1.06)	0.24
Receives therapy visits	0.91 (0.55, 1.50)	0.69

* Data are drawn from National Health and Aging Trends Study (NHATS) and linked Outcomes and Assessment Information Set (OASIS), Medicare claims data, and Provider of Services data for 1,217 Medicare beneficiaries receiving family caregiver assistance during a home health episode between 2011-2016.

JULIA G. BURGDORF

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EDUCATION

Johns Hopkins Bloomberg School of Public Health, Baltimore, MD
PhD in Health Policy and Management, Health Services Research concentration 2016-Present
Dissertation: Impact of Family Caregiver Training Needs on Efficiency and Outcomes during Medicare Home Health
Advisor: Dr. Jennifer L. Wolff

Cornell University, Ithaca, NY
BS in Policy Analysis and Management
Minor in Gerontology 2009-2013

Cornell in Washington Program, Washington, DC
Semester-long internship and independent research program 2012
Thesis analyzing impact of Medicaid 1915c waivers on institutionalization of older adults

PROFESSIONAL EXPERIENCE

Johns Hopkins Lipitz Center for Integrated Health Care, Baltimore, MD
Johns Hopkins Bloomberg School, Department of Health Policy and Management, Baltimore, MD
Research Assistant 2017-Present
- Support ongoing projects focusing on family caregiving and long-term services and supports for older adults.
- Clean and manage data, contribute to research direction, perform quantitative analysis.

The Advisory Board Company, Washington, DC
Senior Analyst 2015-2016
Analyst 2013-2015
- Conducted independent research on national trends in post-acute and long-term care operations and business strategy.
- Identified appropriate research topics, analyzed quantitative data, led interviews with health care executives and topic experts, and developed presentation of findings.
- Monitored federal legislation and CMS programs impacting post-acute and long-term care providers, including IMPACT Act, BPCI program, Independence at Home Demonstration, and Medicaid HCBS waivers.
- Investigated trends in post-acute patient acuity using by analyzing 2010-2013 MedPAR discharge data.

American Public Health Association, Washington, DC
Health Policy Intern 2012
- Attended Senate hearings on proposed legislation before the Health, Education, Labor, and Pensions Committee; briefed senior staff on relevant upcoming federal legislation.
- Authored health policy fact sheets for the APHA website.

Cornell University, Department of Human Ecology, Ithaca, NY
Research Assistant 2011-2013
- Catalogued and summarized existing evidence and research literature to support health behavior research in the field of Gerontology.

Center for Governmental Research, Rochester, NY
Research Intern 2011-2012
- Wrote research summaries, analyzed survey data, and contributed to final reports on a range of projects including multiple financial and operational assessments of county-owned Skilled Nursing Facilities.

Cornell University, Kheel Center for Labor-Management Documentation, Ithaca, NY
Research Assistant 2009-2013
- Responded to primary source research requests from faculty and visiting scholars.

TEACHING EXPERIENCE

Johns Hopkins Bloomberg School, Department of Health Policy and Management, Baltimore, MD
Guest Lecturer 2019-Present
- Guest lecture on *Measuring Quality during Transition of Care* for *Quality of Medical Care for Practitioners* course (Professors Dr. Sydney Dy and Dr. Romsai Boonyasai)

Johns Hopkins Bloomberg School, Department of Health Policy and Management, Baltimore, MD
Teaching Assistant 2017-Present
- Assist with course organization and development, respond to student queries, lead lab sessions, present select lectures, and prepare student grades.
    - *Innovations in Health Care for Aging Populations*
    - *Health Issues for Aging Populations*
    - *Introduction to Health Care Policy*
    - *Quality of Medical Care for Practitioners*
    - *Research Ethics and Integrity*
    - *Assessing Health Status and Patient Outcomes*
    - *Science of Patient Safety*

The Advisory Board Company, Washington, DC 2013-2016
- Created and taught "Introduction to the Health Care System" course for new hires.

LEADERSHIP AND SERVICE EXPERIENCE

Academy Health Long-Term Services and Supports Interest Group
Student Representative 2018 – Present
- Contribute to webinar development, discussion of group outreach strategies.
- Develop newsletter content highlighting interest group members and notable research.

Johns Hopkins Bloomberg School, Department of Health Policy and Management, Baltimore, MD
Co-Chair, Student Coordinating Committee 2017 – 2018
- Served as a liaison between graduate students and department administration, facilitating discussion and advocating for student concerns.

St. Ann's Nursing Home, Rochester, NY
Volunteer 2012
- Shadowed leaders in each department, helped develop a company-wide staff satisfaction survey.

HONORS AND AWARDS

- **Winner, Three-Minute Thesis Competition** 2019
  Presented by AcademyHealth Long-Term Services and Supports Interest Group.
- **Recipient, Pearl and Jeremiah German Scholarship in Gerontology** 2019
  Johns Hopkins Bloomberg School of Public Health.
- **Winner, HSRProj Student Research Competition** (Co-investigators Zachary Predmore, Sarah Gensheimer) 2018
  Presented by Academy Health and National Library of Medicine.
- **Fellow, National Research Service Award** 2016-2019
  Agency for Health Care Research and Quality (T32HS0000029).
- **University Honors** 2013
  Cornell University
- **Dean's List** 2009-2013
  Cornell University

PROFESSIONAL SOCIETY MEMBERSHIPS

- AcademyHealth (2016-present)
- Gerontological Society of America (2019-present)

PUBLICATIONS

Burgdorf J, Arbaje AI, Wolff, JL. (2020). Identified Need for Training among Family Caregivers Assisting during Medicare Home Health. (*Under review.)*

Burgdorf J, Mroz T, Wolff JL. (2020). Reducing Medicare Payments for Community-Entry Home Health May Threaten High-Need Beneficiaries' Access to Home-Based Care. *(Under review.)*

Liu C, Badana A, **Burgdorf J,** Fabius CD, Roth DL, Haley WE. (2019). Systematic Review and Meta-Analysis of Racial and Ethnic Differences in Dementia Caregiver Well-Being. *Gerontologist.* doi: 10.1093/geront/gnaa028.

Burgdorf J, Roth DL, Riffin C, Wolff JL. (2019). Factors Associated with Receipt of Training Among Caregivers of Older Adults. *JAMA Internal Medicine.* doi: 10.1001/jamainternmed.2018/8694.

Burgdorf J, Arbaje AI, Wolff JL. (2019). Older Adult Factors Associated with Identified Need for Family Caregiver Assistance during Home Health Care. *Home Health Care Management & Practice.* doi: 10.1177/1084822319876608.

Burgdorf J, Mulcahy J, Amjad H, Kasper JD, Covinsky K, Wolff JL. (2019). Family Caregiver Factors Associated With Emergency Department Utilization Among Community-Living Older Adults With Disabilities. *Journal of Primary Care and Community Health.* doi:10.1177/2150132719875636

Aufill J, **Burgdorf J,** Wolff JL. (2019). In Support of Family Caregivers: A Snapshot of Five States. *Milbank Memorial Fund and The John A Hartford Foundation*. Available at www.milbank.org/wpcontent/uploads/2019/06/MMF_Caregiver_Report_ 6.19.pdf.

Burgdorf J, Wolff JL, Willink A, Woodcock C, Davis K, Stockwell I. (2018). Expanding Medicaid Coverage for Community-Based Long-Term Services and Supports: Lessons from Maryland's Community First Choice Program. *Journal of Applied Gerontology.* doi: 10.1177/0733464818779942.

Davis K, Willink A, Stockwell I, Whiton K, **Burgdorf J,** Woodcock C. (2018). Designing a Medicare Help at Home Benefit: Lessons from Maryland's Community first Choice Program. *Issue Brief (Commonwealth Fund).* Available at: www.commonwealthfund.org/ publications/issue-briefs/2018/jun/designing-medicare-help-home-benefit-lessons-marylands-community .

Burgdorf J. (2016). Responding to Behavioral Health Needs in the Post-Acute Setting. The Advisory Board Company: Washington, DC.

Burgdorf J & Landis J. (2015). Home Health's Next Frontier: Complex Patient Management. The Advisory Board Company: Washington, DC

Landis J, **Burgdorf J,** Westhead M. (2015). State of the Post-Acute Care Industry: 2015 Trends. The Advisory Board Company: Washington, DC.

Brown H & **Burgdorf J.** (2014). Evaluating Primary Care Models in Senior Living. The Advisory Board Company: Washington, DC.

Burgdorf J & Landis J. (2013). Enhancing Medication Management for High-Complexity Regimens. The Advisory Board Company: Washington DC.

PRESENTATIONS

Burgdorf, J., Stuart, E., Wolff, JL. (2020, June). *"Effects of Family Caregiver Need for Training on Medicare Home Health Care."* Podium presentation at AcademyHealth Annual Research Meeting, Boston, MA.

"Emerging Topics in Family Caregiving Research." (2019, November). Panel chair. Gerontological Society of America 2019 Annual Scientific Meeting, Austin, TX.

Burgdorf, J., Kasper, JD., Arbaje, A., Stuart, E., Wolff, JL. (2019, November). *"Family Caregivers' Need for Training during Medicare Home Health."* Podium presentation at Gerontological Society of America 2019 Annual Scientific Meeting, Austin, TX.

Burgdorf, J., Mulcahy, J., Amjad, H., Kasper, JD., Covinsky, K., Wolff, JL. (2019, November). *"Family Caregiver Factors Associated with Emergency Department Utilization Among Community-Living Older Adults with Disabilities."* Podium presentation at Gerontological Society of America 2019 Annual Scientific Meeting, Austin, TX.

Aufill, J., **Burgdorf, J.,** Wolff, JL. (2019, November). *"State Innovations in Supporting Family Caregivers."* Podium presentation at Gerontological Society of America 2019 Annual Scientific Meeting, Austin, TX.

Burgdorf, J., Roth, DL., Riffin, C., Wolff, JL. *"The Family Caregiver 'Workforce': Who Receives Training?".* (2019, June). Podium presentation at National Research Service Award Trainees Conference, Washington, DC.

Aufill, J., **Burgdorf, J.,** Wolff, JL. *"Best Practices in State Innovation and Support of Family Caregivers".* (2019, January). Presentation at Center for Health Care Strategies 'Helping States Support Families Caring for an Aging America', Washington, DC.

"Aging Populations in Healthcare: The Impact of Long-Term Care and Home Health access on Health Expenditures and Patient Outcomes." (2018, April). Panel moderator and organizer. Yale Health Care Conference, New Haven, CT.

POSTERS

Burgdorf J, Wolff JL. *"The Impact of Cognitive Impairment on Resource Utilization during Medicare Home Health Care."* (2020, March). Poster accepted at National Institute on Aging: National Research Summit on Care, Services, and Supports for Persons with Dementia and their Caregivers. (***Note:*** meeting cancelled.)

Burgdorf, J., Mulcahy, J., Amjad, H., Kasper, JD., Covinsky, K., Wolff, JL. (2019, June). *"Family Caregiver Factors Associated with Emergency Department Utilization Among Community-Living Older Adults with Disabilities."* Poster presentation at AcademyHealth Annual Research Meeting, Washington, DC.

Burgdorf, J., Mulcahy, J., Wolff, J. (2018, June). *"Family Caregiver Characteristics and Subsequent Hospitalization Risk among Community-Dwelling Medicare Beneficiaries."* Poster presentation at AcademyHealth Annual Research Meeting, Seattle, WA.

RESEARCH SUPPORT

Ongoing:

Alliance for Home Health Quality and Innovation — Burgdorf, Julia (PI)
07/2020-07/2021
Challenges and Best Practices in Delivering Family Caregiver Training during Medicare Home Health
We conduct key informant interviews with frontline home health clinicians to provide the first information regarding how clinicians assess family caregivers' need for training during home health, and to identify challenges and best practices related to delivering family caregiver training during Medicare-funded home health episodes.
Role: Principal Investigator

Completed:

T32HS0000029, Agency for Healthcare Research and Quality — Dy, Sydney (PI)
08/2016-08/2019
This National Research Service Award (NRSA) prepares multidisciplinary PhD researchers to assess the organization and quality of care delivery in the United States. The program supports doctoral research training to prepare grantees for high-impact careers in health services research.
Role: Trainee

R01AG047859, National Institute on Aging — Wolff, Jennifer (PI)
09/15/15-05/31/19
Prognostic Significance of Family Caregiver Factors for Older Adult Health Events
This study draws from linked nationally representative disability and family caregiver surveys, administrative claims, and vital statistics files to determine whether and which family caregiver factors predict disabled older adults' risk for all-cause hospitalization, nursing home entry, and all-cause mortality and to develop prognostic models for these outcomes.
Role: Research Assistant

Milbank Memorial Fund — Wolff, Jennifer (PI)
04/15/18-11/30/18
Best Practices in State Support for Family Caregivers
This policy project describes best practices and compiles lessons from forward-thinking states that have successfully developed, implemented, and sustained more comprehensive and/or innovative family caregiver support policies.
Role: Research Assistant

The Commonwealth Fund, Grant 20160725 — Davis, Karen (PI)
01/2017-08/2017
Lessons from Community First Choice Program in Maryland
This study leverages key stakeholder interviews to draw inferences surrounding Medicaid expansion of home-based long-term services and supports coverage. State-level challenges are explored and strategies to successfully implement personal care coverage expansion are discussed. Special attention is given to direct payment of caregivers.
Role: Research Assistant

RELATED SKILLS

- Stata, SAS, Microsoft Office Suite